april, 1960

nlgi spokesman

journal of the national lubricating grease institute

Review and Forecast of Grease Manufacture

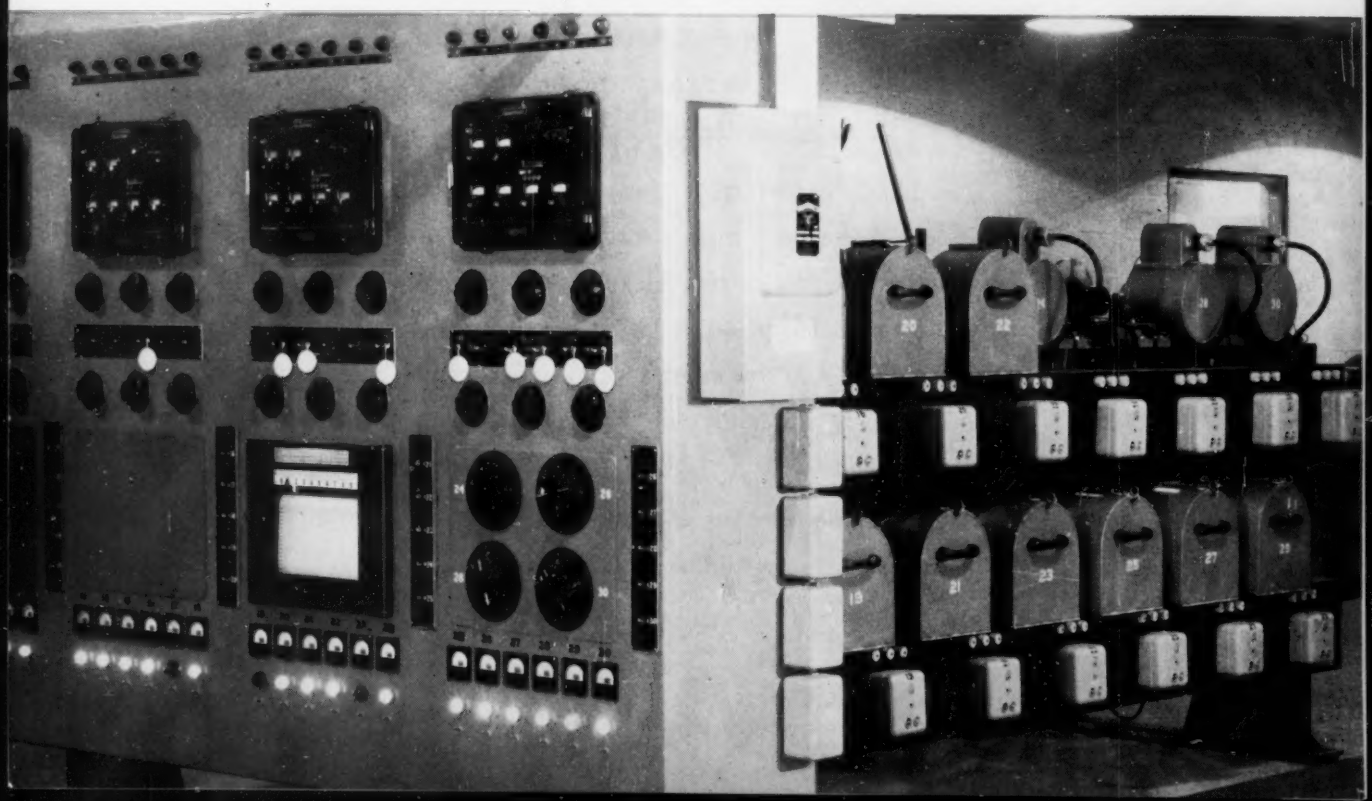
By H. W. STRATFORD

Grease Evaluation by Bearing Performance Tests

By J. R. BELT and NATHAN GLASSMAN

GREASE CONTAINERS: Past, Present and Future

By W. R. HOSLER



now available *now available*

NLGI SPOKESMAN

VOLUME XXIII

Latest Issue of Institute's Journal In Bound Volumes Offered to Readers

A reference work which is both handsome and practical . . . Volume XXIII of the NLGI SPOKESMAN contains the twelve issues between April, 1959 and March of 1960 . . . 36 features on every phase of the lubricating and fluid gear lubricants industries. Some categories:

> Automobiles . . . automatic transmission fluids . . . fatty acids . . . manufacture . . . non-soap . . . non-soap thickeners . . . testing . . . gear lubricants . . . marketing . . . non-lubricated bearings . . . and others.

The sturdy green cover holds all twelve issues securely, with an index in the final magazine broken down by author, title and category. A few copies of Volume XXI and XXII are also available. Write NLGI, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. $7.50 for members, $10.50 for friends of NLGI, plus postage.

Volumes I through XXIII may be purchased from University Microfilms, 313 North First Street, Ann Arbor, Michigan.

nlgi spokesman

Volume XXIV April, 1960 Number 1

Published Monthly by the National Lubricating Grease Institute, T. W. H. MILLER, Editor; VIRGINIA ALLEN, Assistant Editor, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. Telephone: VAlentine 1-6771. 1 Year Subscription, $5.00. 1 Year Subscription (Foreign), $6.00.

OFFICERS

President: H. A. MAYOR, JR., Southwest Grease and Oil Co., 220 W. Waterman, Wichita, Kans.

Vice-President: F. R. HART, Standard Oil Co. of California, 225 Bush Street, San Francisco, Calif.

Secretary: C. L. JOHNSON, Jesco Lubricants Co., P. O. Box 7331, North Kansas City, Mo.

Treasurer: A. J. DANIEL, Battenfeld Grease and Oil Corp., Inc., 3148 Roanoke Road, Kansas City 11, Mo.

DIRECTORS

W. W. ALBRIGHT, Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.

S. C. M. AMBLER, British American Oil Co., Bay & College St., Toronto, Ontario, Can.

T. W. BINFORD, D-A Lubricant Co., Inc., 29th St. and Canal, Indianapolis 23, Ind.

E. W. CAMPBELL, Gulf Oil Corp., Gulf Building, Pittsburgh, Pa.

J. J. COATES, Esso Standard Div., Humble Oil & Refining Co., 34th and Smallman St., Pittsburgh 1, Pa.

R. CUBICCIOTTI, Sonneborn Chemical & Refining Corp., 300 Park Avenue, South, New York, N. Y.

GEORGE LANDIS, Atlantic Refining Co., 260 S. Broad St., Philadelphia 1, Pa.

J. W. LANE, Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York 17, N. Y.

W. A. MAGIE, II, Magie Brothers Oil Co., 9101 Fullerton Avenue, Franklin Park, Ill.

G. E. MERKLE, Fiske Brothers Refining Co., 129 Lockwood Ave., Newark 5, N. J.

F. W. MINOR, Sinclair Refining Co., 600 Fifth Avenue, New York 20, N. Y.

W. M. MURRAY, Kerr-McGee Oil Industries, Inc., Kerr-McGee Bldg., Okla. City, Okla.

G. A. OLSEN, Sunland Refining Corp., P. O. Box 1512, Fresno, Calif.

F. E. ROSENSTIEHL, Texaco, Inc., 135 East 42nd Street, New York 17, N. Y.

W. H. SAUNDERS, JR., International Lubricant Corp., Box 390, New Orleans, La.

T. F. SHAFFER, Shell Oil Co., 50 West 50th Street, New York 20, N. Y.

Technical Committee Chairman: L. C. BRUNSTRUM, Standard Oil Co. (Indiana) Whiting Research Laboratory, Box 431, Whiting, Ind.

General Manager: T. W. H. Miller, NLGI, 4638 J. C. Nichols Parkway, Kansas City 12, Mo., VAlentine 1-6771

IN THIS ISSUE

President's Page 2

News About NLGI 4

Future Meetings 8

Review and Forecast of Grease Manufacture 12

H. W. Stratford, Consulting Engineer

Grease Evaluation by Bearing Performance Tests 15

J. R. Belt and Nathan Glassman, U. S. Naval Engineering Experiment Station, Annapolis, Md.

Grease Containers: Past, Present and Future 21

W. R. Hosler, Battenfeld Grease & Oil Corp., Inc.

Literature and Patent Abstracts 25

Industry News 32

People in the Industry 36

THE COVER

THIS end view of a multiple grease tester assembly is part of the story on development and use of functional grease ball-bearing performance testers by the United States Navy, as told by J. R. Belt and Nathan Glassman in their article, "Grease Evaluation by Bearing Performance Tests." Thirty test units in the tester allow researchers to provide adjustable control on a number of variables . . . temperature, speed, bearing size and bearing load. Part of the work done resulted in the CRC Method L-35, another step based on Federal Test Method 331.1. See page 15.

The NLGI SPOKESMAN is indexed by Industrial Arts Index and Chemical Abstracts. Microfilm copies are available through University Microfilm, Ann Arbor, Mich. The NLGI assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the NLGI. Copyright 1960. National Lubricating Grease Institute.

NLGI PRESIDENT'S PAGE

By H. A. MAYOR, JR., *President*

An Open Letter of Interest To All NLGI Members

Mr. John McCollister
McCollister Grease & Oil Corporation
20th & William Streets
Omaha 2, Nebraska

Dear John:

The publication of your very effective 1959 Annual Meeting Paper entitled "More Sales–For You and Your Industry" in the March issue of the SPOKESMAN, gave me another occasion to study and consider its important contents. This restudy was very refreshing in view of the Board deliberations that revolved around certain of your suggestions during our St. Louis meeting last month.

Your NLGI Board recognizes, as you do, that difficult problems do confront our industry and that, in the face of our problems, our best hope for progress is a joint, concerted, industry effort.

Inspired by your good work, and challenged by the ideas you have presented, an NLGI plan of action is slowly crystallizing. Maybe 1960 will see the birth of a full-fledged NLGI Marketing Committee. Wouldn't that be a good way for our industry to launch the Soaring Sixties decade?

Yours very truly,

H. A. MAYOR, JR.
President

LABORATORY REPORT

Testing proves Baragel* and Baragel* 24 grease effectiveness

BARAGEL grease tests being conducted continuously

Tests are constantly being conducted using BARAGEL and BARAGEL 24 in greases made from both petroleum and non-petroleum base oils. The greases are formulated from refined oils of varying viscosities with selected dispersion aids.

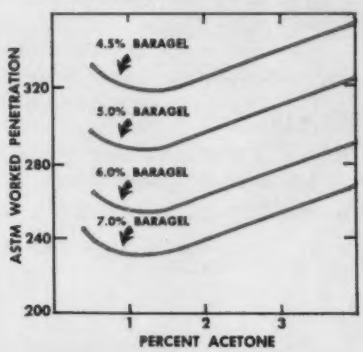
BARAGEL and BARAGEL 24 are versatile, non-soap grease gelling agents consisting of mixed organic ammonium halides and refined sodium montmorillonite. Test results are available in printed form. If you are not already on the mailing list, you can obtain Data Sheets by writing Baroid Chemicals, Inc.

BARAGEL very versatile in greases made with oils of varying viscosity indexes

BARAGEL is considerably more efficient than BENTONE* 34 in greases compounded with solvent refined, high VI oils. Greases having an ASTM worked penetration in the 315 range require about 4.5% BARAGEL compared to a BENTONE 34 requirement of about 5.75%.

BARAGEL has also proved to be efficient in greases compounded with conventionally refined oils of relatively low viscosity index. Tests were made with a base oil of 21.5° API gravity and a viscosity of 517 SUS at 100° F.

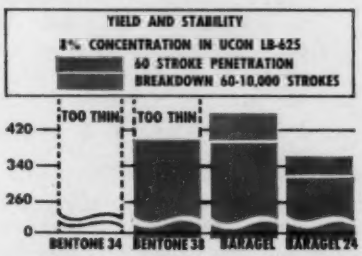
BARAGEL was stirred into the oil, acetone added and stirred, and the mixture was milled. Greases having an ASTM worked penetration in the 315 range required about 4.5% BARAGEL, while greases in the 280 range required about 5.5% BARAGEL. Data Sheet A-3, available on request, gives full details of this test.



Greases made with Ucon LB-625

BARAGEL 24 is more efficient in thickening Ucon LB-625 than are BENTONE 34, BENTONE* 38 and BARAGEL. BARAGEL 24 greases are also more stable to working in the ASTM grease worker.

In a series of tests, the gelling agents were stirred into the Ucon LB-625, propylene carbonate was added, heat applied, and the mixture



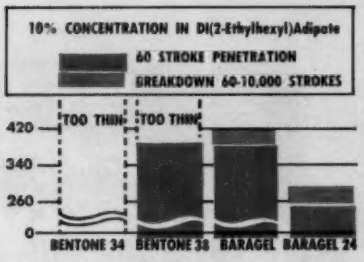
was milled. The chart above compares the results of thickening greases with BENTONE 34, BENTONE 38, BARAGEL and BARAGEL 24. Full details of these tests are available in Data Sheet A-1.

The worked penetration of a grease made from Ucon LB-625 and 8% BARAGEL 24 was 315, with a penetration of 355 after working 10,000 strokes.

BARAGEL 24 efficient in greases made with Di(2-Ethylhexyl) Adipate

BARAGEL 24 has been proved by tests to be particularly efficient in thickening greases made with Di(2-Ethylhexyl) Adipate. Greases prepared with BARAGEL 24 are also much more stable to working in the ASTM grease worker.

Tests were made to compare results when thickening greases with BENTONE 34, BENTONE 38, BARAGEL and BARAGEL 24. The results are shown in the accompanying chart and



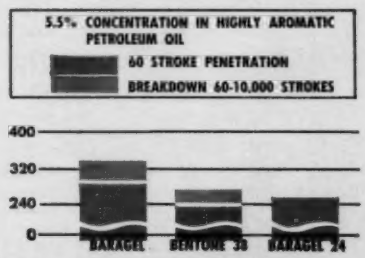
details are available in Data Sheet A-2.

Greases made with Di(2-Ethylhexyl) Adipate and 10% BARAGEL 24 showed worked penetrations of 260. After working 10,000 strokes, these same greases showed a penetration of only 290.

BARAGEL 24 in grease made with petroleum oil

In a particular petroleum oil of high aromatic content (28%), BARAGEL 24 produces a grease completely stable to working in the ASTM grease worker over the range of unworked to 10,000 strokes.

In a series of tests, the oil used had an API gravity of 16.9° at 60° F and a viscosity of 309 SUS at 100° F. The worked penetration was 265 when 5.5% BARAGEL 24 was used. Comparisons of penetration when using the same per cent of BENTONE 34 and BARAGEL are shown on the accompanying chart. Full details are available in Data Sheet A-4.



BAROID
BAROID CHEMICALS, INC.
A SUBSIDIARY OF NATIONAL LEAD COMPANY
1300 SOUTH COAST BUILDING
HOUSTON 2, TEXAS
*Trademarks of National Lead Company for its specific thickeners and dispersants.

News About NLGI

Pennsylvania Refining Joins NLGI

Pennsylvania Refining company of Cleveland has joined NLGI as a Marketing member firm. Mr. Ben Sollitto will serve as Company Representative, while Mr. G. F. Fenker will act as Technical Representative. A feature article will be offered on this company at a later date.

Du Pont Joins NLGI

E. I. Du Pont De Nemours has joined the Institute in an Associate member capacity. J. U. Mikita, technical manager of the petroleum chemicals division, will act as Company Representative of the Wilmington firm. An article on this firm will be presented in a new member feature, in a later issue of the journal.

Change in Representatives

BP (North America) has named G. N. Griffiths as Company Representative to NLGI, replacing K. S. Cuddington, who has returned to London for reassignment from the New York office.

May Board Meeting

There will be a meeting of the NLGI Board of Directors on Saturday, May 14, 1960 at the Bedford Springs hotel, Bedford, Pa.

Miller Is Representative

United Cooperatives of Alliance, Ohio, an NLGI Marketing member, has named A. J. Miller as Company Representative. Miller, manager of the petroleum department, replaces G. E. Castree, who has entered private business.

Joint Container Committee Report

The Petroleum Packaging Committee met in Wichita, Kansas on February 1, 1960. *The following report was tendered by W. A. Magie, II, who acts as a representative for both NLGI and the API lubrication committee, division of marketing. Some of the items discussed were as follows:*

1. Light Gauge Packages

a. 55-Gal. 20/18 Gauge Drums—Some reconditioners have changed their attitude, and now favor the use and reuse of 20/18 drums. Mobil Oil has a permit from the Bureau of Explosives to reuse 17E drums with 20 gauge sides and 18 gauge ends, for liquids flashing above 20°F., provided the drums are stamped "Retested and Approved for Reuse by Bureau of Explosives."

b. Strikes have interferred with securing shipping data on light gauge 16-gallon full-removable-head lug-cover drums and 5-gallon LC pails. Such data are needed to secure change in freight classification rules. Several major companies are set to try shipments of the new-design 5-gallon 26 gauge pails (with two beads and new handle). Approximately 6,000 28 gauge pails (having two beads) have been shipped from New Orleans to Minneapolis with good results.

c. Asphalt Drum—A 33-34 gauge 150-pound tapered drum is being investigated. The empty drums nest readily, and freight savings are involved.

2. Standard Drums

a. The revised American Standards for ten metal drums and pails, MH 2. 1 through MH 2. 10, were published approximately the first of the year. They are available from the American Standards Association at $1.00 per copy.

b. Redesign of the 400-pound full-removable-head drum to get the same ocean cube as the 55-gallon drum has been tabled pending the outcome of an Ocean Shipping Conference. At the conference an attempt is to be made to have a 55-gallon, 400-pound drum considered as a drum, without reference to ocean cube.

3. Shipping Cases

a. American Standard MH 7. 1 has been published, covering the sizes of 13 shipping cases most commonly used by the petroleum industry. The Packaging Institute has published the proposed standard method for measuring interior dimensions of corrugated fibreboard boxes.

b. Conversion of present boxers to the 28-quart diagonal pack is hardly practical. The economics of new equipment is being studied.

c. Gap Flap Cases—The Rail and Truck Classification committee has approved use of gap flap cases for lube oil, by rail in CL and LCL shipments, but by truck in TL shipments only.

4. Miscellaneous

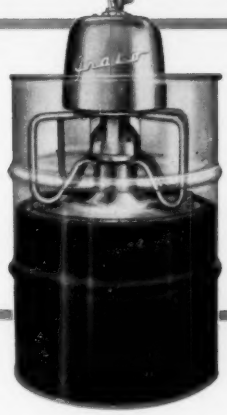
a. The Army is considering lubricant shipments in large "universal shipping containers," possibly 20′ x 14′ x 8′. General interest is developing in large bulk packages (larger than 55-gallon, smaller than tank car).

b. The new chairman of the Petroleum Packaging committee is Mr. L. E. Stuart of Continental Oil company.

c. The next meeting of the PPC will be in Philadelphia June 20 and 21, 1960.

Transfers grease 200 Pounds per minute!

(...and cleans drum "whistle clean")



●Designed for transfer, batching and packaging operations where grease is removed from drums, the Graco Bulldog Transfer Pump delivers up to 200 lbs. per minute of heavy grease and other semi-solid materials . . . *empties a 55-gal. drum in less than 3 minutes!*

High volume pump starts at TOP of drum, "sucks" way to bottom, cleans drum as it moves. Handles heavy greases in a fraction of the time needed by ordinary pumps. When drum is empty (right), pump can be quickly removed. *Ask for a demonstration!*

FREE IDEA BOOK shows economical Graco air-powered, direct-from-drum pumps for every need. Send for your free copy today!

GRACO

"DIRECT-FROM-DRUM" PUMPS

GRAY COMPANY, INC.

428 Graco Square • Minneapolis 13, Minnesota

(For Graco Suppliers, see under SPRAYING or LUBRICATING DEVICES in Phone Book Yellow Pages)

Please send me a copy of your "Idea Book" on Graco direct-from-drum pumps.

Name_____

Firm_____

Address_____

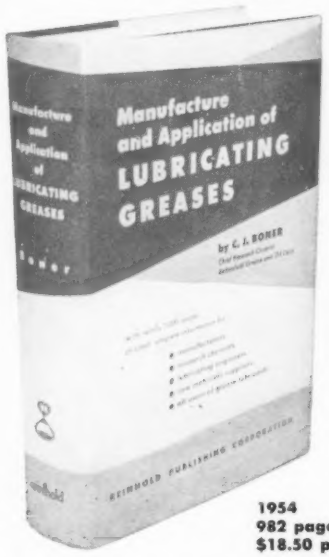
City_____ Zone____ State_____

Available!

Manufacture and Application of LUBRICATING GREASES

by C. J. Boner

Chief Research Chemist
Battenfeld Grease and Oil Corp.



1954
982 pages
$18.50 prepaid

982
FACT-FILLED PAGES
IN THESE
23
BIG CHAPTERS

1 Introduction
2 Structures and Theory
3 Additives Other Than Structural Modifiers
4 Raw Materials
5 Manufacturing Processes
6 Equipment for Lubricating Grease Manufacture
7 Aluminum Base Lubricating Greases
8 Barium Base Lubricating Greases
9 Calcium Base Lubricating Greases
10 Lithium Base Lubricating Greases
11 Sodium Base Lubricating Greases
12 Lead Soap Lubricating Greases
13 Strontium Base Lubricating Greases
14 Miscellaneous Metal Soaps as Components of Lubricating Greases
15 Mixed Base Lubricating Greases
16 Complex Soap Lubricating Greases
17 Non-Soap Thickeners for Lubricating Fluids
18 Fillers in Lubricating Greases and Solid Lubricants
19 Residua and Petrolatums as Lubricants
20 Analysis of Lubricating Greases
21 Tests of Lubricating Greases and Their Significance
22 Application of Lubricating Greases
23 Trends in Lubricating Greases

Here in one giant volume . . . the most complete storehouse of information ever published on the composition, properties and uses of lubricating greases!

The book begins by describing in detail the structure and theory of lubricating greases. Then follow chapters on the various raw materials, processes and manufacturing equipment. Lubricants containing specific thickeners, including such recent developments as lithium soaps, complex soaps and non-soap gelling agents, receive special attention.

Of major interest is the large section on present uses and future trends of lubricating grease products. Here you'll find the complete details of when, where, and how to apply a specific lubricant for any given purpose.

Everyone concerned with the preparation or use of grease lubricants will find Boner's book of enormous practical value. Manufacturers and lubricating engineers will find here a complete breakdown of the effects of each ingredient of treatment upon the characteristics of the final product, and a full explanation of the physical and chemical methods used in measuring these characteristics. Suppliers of fats, oils, additives, thickeners and other raw materials will gain new ideas for future product research and development. In addition, users of grease products will learn the properties of available lubricants and the major purposes that each fulfills.

MAIL THIS HANDY ORDER COUPON TODAY!

NLGI SPOKESMAN
4638 J. C. Nichols Parkway
Kansas City 12, Missouri

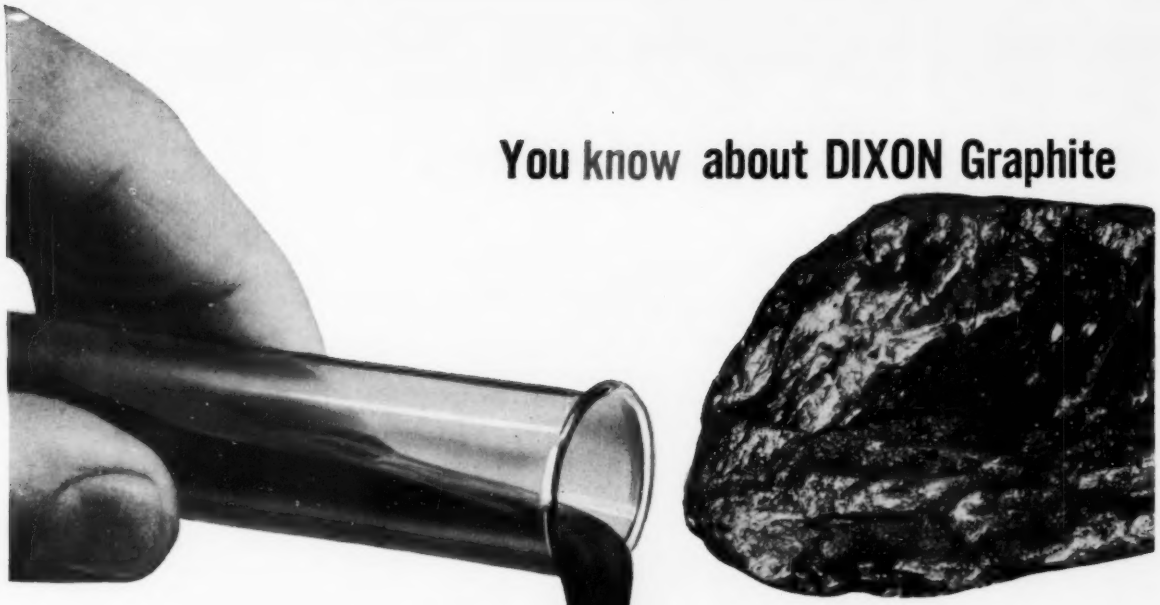
Please rush me a copy of Boner's MANUFACTURE AND APPLICATION OF LUBRICATING GREASES.

☐ I am enclosing $18.50
☐ Company Purchase Order

NAME_____

ADDRESS_____

CITY & ZONE_____ STATE_____



You know about DIXON Graphite

Did you know about DIXON Colloidal NATURAL GRAPHITE?

Years of research, refining and testing have resulted in the world's finest colloidal *natural* graphite, which is available in a wide range of dispersions designed for the specialized needs of various industries.
In addition to the basic dispersion vehicles listed below, Dixon is constantly formulating new ones to suit unusual requirements. A *partial* listing includes:
• OIL • WATER • SYNTHETIC FLUIDS • SPECIAL VEHICLES

Dixon Colloidal Graphite serves many industries, many applications, including:
- AUTOMOTIVE (lubricants)
- FORGING
- DIE-CASTING
- PERMANENT MOLDING
- EXTRUSION
- GLASS Molding and all other high-temperature, extreme pressure applications

In addition, Dixon manufactures dry-film concentrates and conductive coatings.

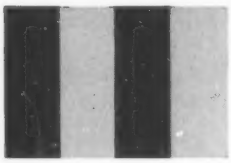
DON'T FORGET TO SEE US AT
THE APRIL A.S.L.E. SHOW, BOOTH 22
NETHERLAND HILTON HOTEL, CINCINNATI, OHIO

D X N
TRADE MARK

EXCELLENCE SINCE 1827

Graphite & Lubricants Division

THE JOSEPH DIXON CRUCIBLE CO., INC. • Jersey City, New Jersey



Future Meetings

APRIL, 1960

19-20 ASLE, Annual Meeting and Exhibit, Netherland—Hilton Hotel, Cincinnati.

20-22 API Division of Production, Rocky Mountain District Meeting, Gladstone, Henning, & Townsend Hotels, Casper

20-21 National Petroleum Association Spring Meeting, Sheraton Cleveland Hotel, Cleveland, Ohio.

MAY, 1960

9-12 API Division of Refining Midyear Meeting, Statler and Sheraton-Cadillac Hotels, Detroit.

16-17 API Division of Marketing, lubrication committee meeting, Bedford Springs Hotel, Bedford Springs, Pa.

18-20 API Division of Marketing Midyear Meeting, Statler-Hilton Hotel, Cleveland

JUNE, 1960

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago

SEPTEMBER, 1960

11-16 American Chemical Society, 138th National Meeting, headquarters undecided, New York.

14 API Division of Marketing, lubrication committee meeting, Hotel Traymore, Atlantic City, New Jersey.

14-16 National Petroleum Association Annual Meeting, Hotel Traymore, Atlantic City, New Jersey.

18-20 IOCA 13th Annual Meeting, Hotel Moraine, Highland Park, Ill.

18-21 ASME Petroleum Mechanical Engineering Conference, Jung Hotel, New Orleans.

OCTOBER, 1960

17-19 ASME — ASLE Lubrication Conference, Statler Hilton Hotel, Boston.

OCT. 30-NOV. 1 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago

NOVEMBER, 1960

2 Packaging Institute, petroleum packaging committee meeting, headquarters undecided, New York.

3-4 SAE National Fuels and Lubricants Meeting, Mayo Hotel, Tulsa, Okla.

14-16 API 40th Annual Meeting, Conrad Hilton, Palmer House and Congress Hotels, Chicago.

27-Dec. 2 ASME Annual Meeting, Statler Hilton Hotel, New York.

JANUARY, 1961

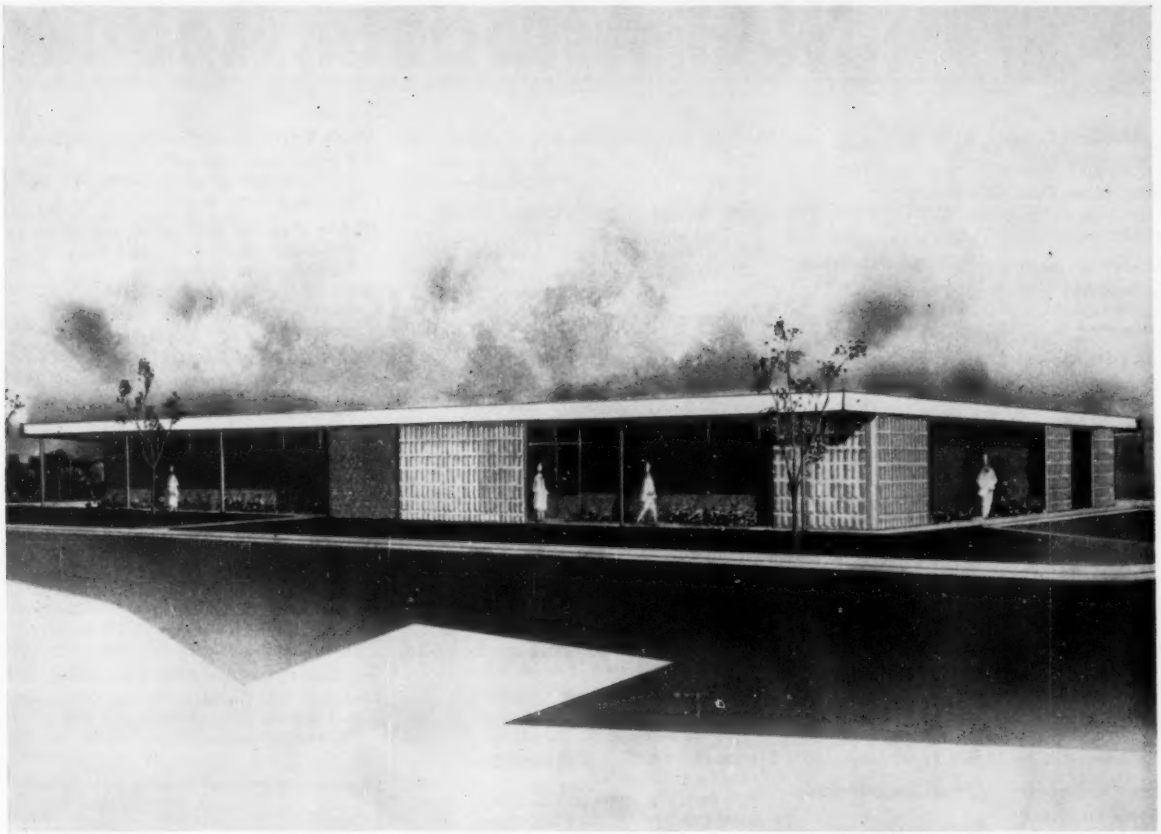
9-13 Society of Automotive Engineers Annual Meeting, Cobo Hall and Convention Arena, Detroit.

ADVANTAGES
of membership in the
National Lubricating Grease Institute

Some of the membership advantages are listed below:

- The NLGI represents over 95 per cent of the lubricating grease industry with members in this country and overseas.
- NLGI has a Technical Committee of 154 members which is divided into nine sub-committees working constantly on industry problems.
- The NLGI SPOKESMAN, a monthly technical journal, is mailed free of charge to key personnel within a member firm. If extra copies of the magazine are needed, they may be purchased at half the regular subscription price.
- The Institute works in close cooperation with affiliated groups including SAE, ASTM, ASA, ASLE, ASME, SAE-Cimtc and IOCA on problems and accomplishments in the lubricating field.
- The main objectives of the National Lubricating Grease Institute are for the development of better lubricating greases for the consumer and better grease lubrication engineering service to industry.

If your firm is interested in becoming affiliated with NLGI, the national office will be happy to furnish further information concerning the organization. Just as 1959 was a banner year for NLGI accomplishments 1960 promises to be even better with more scope and more member advantages.



NEW "NERVE CENTER" GOING UP!

The nerve center of any industry is the office . . . and we're pleased to report that our completely new office building, which will be almost twice as big as the one destroyed by fire, is now under construction. As shown in the architect's sketch above, the building is contemporary in design and will house the very latest in office machines and equipment to quickly and efficiently process inquiries, orders, billing, etc.

A new and modern maintenance garage for servicing our company's fleet of 25 truck and trailer units has been erected and our new products research and control laboratory, which was being expanded before the fire, is nearing completion.

The oil and grease manufacturing plants, which were almost completely destroyed, are being rebuilt—the new oil plant is scheduled to be completed by mid-summer and construction of the grease plant will have begun by that time.

Claude C. Huffman, president of Cato says, "If everything goes as planned our entire rebuilding program will be finished by the end of this year and our facilities for serving you will be the best in the industry."

CATO OIL AND GREASE COMPANY

Oklahoma City, Oklahoma

NLGI Associate, Technical

CONTAINER AND CLOSURE MANUFACTURERS

American Can Company
100 Park Avenue, New York 17, N. Y.
Representative—H. T. Rich

American Flange & Manufacturing Company, Inc.
30 Rockefeller Plaza, New York 20, N. Y.
Representative—Richard L. Parish, Jr.

Bennett Industries
Peotone, Illinois
Representative—S. A. Bennett

Central Can Company
2415 West 19th St., Chicago 8, Ill.
Representative—Henry Frazin

Cleveland Container Company
4925 So. Halsted St., Chicago 9, Ill.
Representative—R. D. Sayles

Continental Can Company, Inc.
100 East 42nd St., New York 17, N. Y.
Representative—W. J. Flint

Geuder, Paeschke & Frey Company
324 North Fifteenth St., Milwaukee 1, Wis.
Representative—Neil Savee

Inland Steel Container Company
6532 South Menard Ave., Chicago 38, Ill.
Representative—J. Daniel Ray

Jones & Laughlin Steel Corporation
Container Division
405 Lexington Ave., New York 17, N. Y.
Representative—C. K. Hubbard

National Steel Container Corp.
6700 South LeClaire Ave., Chicago 38, Ill.
Representative—Henry Rudy

The Ohio Corrugating Company
917 Roanoke Ave. S. E., Warren, Ohio
Representative—Lawrence F. McKay

Republic Steel Corporation
Container Division
465 Walnut Street, Niles, Ohio
Representative—Theodore Humphrey

Rheem Manufacturing Company
400 Park Ave., New York 22, N. Y.
Representative—F. J. Blume

Rieke Metal Products Corporation
Auburn, Indiana
Representative—Raymond F. Over

Sefton Fibre Can Company
Div. Container Corp. of America
3275 Big Bend Blvd., St. Louis, Mo.
Representative—W. V. Swofford

Steel Package Division of National Lead Company
722 Chestnut Street, St. Louis 1, Mo.
Representative—Warren T. Trask

United States Steel Products
Division, United States Steel Corporation
30 Rockefeller Plaza, New York 20, N. Y.
Representative—Wm. I. Hanrahan

Vulcan Containers, Inc.
P. O. Box 161, Bellwood, Ill.
Representative—V. I. McCarthy, Jr.

ENGINEERING SERVICES

The C. W. Nofsinger Company
307 East 63d Street, Kansas City 13, Mo.
Representative—C. W. Nofsinger

Sumner Sollitt Co.
307 N. Michigan Ave., Chicago 1, Ill.
Representative—A. J. Barth

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

Balcrank, Inc.
Disney near Marburg, Cincinnati 9, Ohio
Representative—Richard P. Field

The Farval Corporation
3249 East 80th St., Clevoland, Ohio
Representative—Lee Witzenburg

Gray Company, Inc.
60 Northeast 11th Ave., Minneapolis 13, Minn.
Representative—B. A. Beaver

Lincoln Engineering Company
5701 Natural Bridge Ave., St. Louis 20, Mo.
Representative—G. A. Hubbard

Stewart-Warner Corporation
Alemite Division
1826 Diversey Parkway, Chicago 14, Ill.
Representative—E. G. Wicklatz

MARKETING ORGANIZATIONS

Ampol Petroleum, Ltd.
Buchanan Street
Balmain, New South Wales, Australia
Representative—L. Ashley

California-Texas Oil Company
380 Madison Ave., New York 17, N. Y.
Representative—Hal U. Fisher

Canadian Petrofina Limited
505 Dorchester Street West
Montreal, Quebec, Canada
Representative—M. E. Wight

Cooperative GLF Exchange, Inc.
Terrace Hill, Ithaca, N. Y.
Representative—W. S. Miller

Denco Petroleum Company
5115 Denison Avenue, Cleveland 2, Ohio
Representative—I. L. Carmichael

Derby Refining Co.
420 West Douglas, Wichita, Kan.
Representative—W. B. Neil

D-X Sunray Oil Company
Mid-Continent Bldg., P. O. Box 381, Tulsa, Okla.
Representative—J. W. Basore

Farmer's Union Central Exch., Inc.
P. O. Box G, St. Paul 1, Minn.
Representative—H. F. Wagner

Illinois Farm Supply Company
100 East Ohio Street, Chicago, Ill.
Representative—S. F. Graham

Ohio Farm Bureau Cooperative Association, Inc.
245 North High Street, Columbus 16, Ohio
Representative—Walter N. Callahan

Pennsylvania Refining Company
2686 Lisbon Road, Cleveland 4, Ohio
Representative—Ben Sollitto

United Co-Operatives, Inc.
111 Glamorgan, Alliance, Ohio
Representative—A. J. Miller

Valvoline Oil Company
Division of Ashland Oil & Refining Co.
Box G, Freedom, Penna.
Representative—D. A. Smith

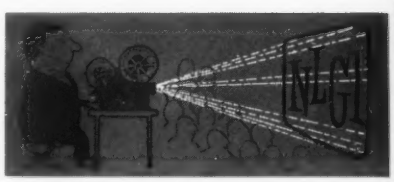
SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Barrett Manufacturing Company
P. O. Box 8096, Houston 4, Texas
Representative—George J. Barrett, Jr.

Chemicolloid Laboratories, Inc.
55 Herricks Road, Garden City Park, N. Y.
Representative—David F. O'Keefe

Girdler Process Equipment Division, Chemetron Corp.
P. O. Box 43, Louisville 1, Ky.
Representative—J. E. Slaughter, Jr.

nlgi



4638 J. C. Nichols Parkway

and Marketing Members

Manton-Gaulin Mfg. Co., Inc.
44 Garden Street, Everett 49, Mass.
Representative—J. J. Dwyer

Renick & Mahoney, Inc.
380 Second Ave., N. Y. 10, N. Y.
Representative—R. Abarno

Stratford Engineering Corporation
612 W. 47th Street, Kansas City 12, Mo.
Representative—D. H. Putney

Struthers Wells Corp.
1003 Pennsylvania Ave. West, Warren, Pa.
Representative—K. G. Timm

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

American Cyanamid Company
30 Rockefeller Plaza, New York 20, N. Y.
Representative—B. H. Loper

American Potash & Chemical Corp.
99 Park Avenue, New York 16, N. Y.
Representative—W. F. O'Brien

Archer-Daniels-Midland Company
Chemical Products Division
P. O. Box 532, Minneapolis 40, Minn.
Representative—J. H. Kane

The Baker Castor Oil Company
120 Broadway, New York 5, N. Y.
Representative—J. W. Hayes

Baroid Chemicals, Inc.
A subsidiary of National Lead Company
1809 South Coast Life Building
Houston 2, Texas
Representative—Mr. C. M. Finlayson

Godfrey L. Cabot, Inc.
125 High Street
Boston 10, Mass.
Representative—H. P. Donohue, Jr.

Climax Molybdenum Company
500 Fifth Ave., New York 36, N. Y.
Representative—Elwin E. Smith

Darling & Company
4201 South Ashland Ave., Chicago 9, Ill.
Representative—G. W. Trainor

E. I. du Pont de Nemours & Company, Inc.
Wilmington 98, Delaware
Representative—Joseph J. Mikita

The Elco Lubricant Corporation
Jennings Road & Denison Avenue
Cleveland 9, Ohio
Representative—R. K. Smith

Emery Industries, Inc.
4300 Carew Tower, Cincinnati 2, Ohio
Representative—G. W. Boyd

Enjay Company, Inc.
15 West 51st St., New York 19, N. Y.
Representative—Brian Casey

Foote Mineral Company
18 W. Chelten Ave., Philadelphia 44, Penna.
Representative—W. F. Luckenbach

A. Gross and Company
295 Madison Avenue, New York 17, N. Y.
Representative—Eugene W. Adams

The C. P. Hall Company of Illinois
5145 West 67th St., Chicago 38, Ill.
Representative—J. E. Stonis

Harchem Division Wallace & Tiernan, Inc.
25 Main St., Belleville, N. J.
Representative—W. G. McLeod

Humko—Chemical Department
P. O. Box 4607, Memphis 7, Tenn.
Representative—W. J. O'Connell

Lithium Corporation of America, Inc.
Rand Tower, Minneapolis 2, Minn.
Representative—Malcolm M. Moore

The Lubrizol Corporation
Box 3057—Euclid Station, Cleveland 17, Ohio
Representative—J. L. Palmer

Mallinckrodt Chemical Works
2nd & Mallinckrodt Sts., St. Louis 7, Mo.
Representative—D. B. Batchelor

The McGean Chemical Co.
Midland Building, 101 Prospect Ave., N. W.
Cleveland 15, Ohio
Representative—W. A. Ritchie

Metasap Chemical Company
A subsidiary of Nopco Chemical Co.
60 Park Place, Newark, N. J.
Representative—T. J. Campbell

Monsanto Chemical Company
800 North Twelfth Blvd., St. Louis 1, Mo.
Representative—J. W. Newcombe

Newridge Chemical Company
7025 West 66th Place, Chicago 38, Ill.
Representative—T. E. Shine

M. W. Parsons—Plymouth, Inc.
59 Beekman St., New York City 38, N. Y.
Representative—Herbert Bye

Werner G. Smith, Inc.
1730 Train Avenue, Cleveland 13, Ohio
Representative—W. Meckes, Jr.

Swift & Company
165th & Indianapolis Blvd., Hammond, Ind.
Representative—F. H. Beneker

Synthetic Products Company
1636 Wayside Rd., Cleveland 12, Ohio
Representative—Garry B. Curtiss

Witco Chemical Company
122 East 42nd St., New York 17, N. Y.
Representative—E. F. Wagner

TECHNICAL AND RESEARCH ORGANIZATIONS

Battelle Memorial Institute
505 King Avenue, Columbus 1, Ohio
Representative—S. L. Cosgrove

The Chek-Chart Corporation
33 East Congress Parkway, Chicago 5, Ill.
Representative—H. Eldridge

Chemico (Pty.) Ltd.
Miller and 7th Streets, P. O. Box 6349,
New Doornfontein, Johannesburg,
South Africa
Representative—O. Richter

Compagnie Francaise De Raffinage
11 Rue du Dr. Lancereaux, Paris VIII^e, France
Representative—Albert E. Miller

Institut Francais du Petrole
CMrR—Courtel, 4 Place Bir Hackeim
Rueil—Malmaison (S. et Oise) France

Laboratoires de Recherches Purfina S.A.
98/100 Chaussee de Vilvorde,
Bruxelles (N.O.H.), Belgium
Representative—R. Gillerot

Phoenix Chemical Laboratory, Inc.
3953 W. Shakespeare Ave., Chicago 47, Ill.
Representative—Mrs. G. A. Krawetz

film

"GREASE—THE MAGIC FILM" tells in 25 fast-moving minutes the wonderful story of lubricating grease, how this magic substance makes modern mechanical progress possible, and of the research and testing to insure a constantly better product. The 16mm movie, subsidized by NLGI, in sound and color, can also be obtained for foreign voice narration.

Kansas City 12, Missouri

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

Review and Forecast of Grease Manufacture

By: H. W. Stratford
Consulting Engineer

Review of Grease Manufacturing

Manufacture of grease has been an important industry to mankind for quite some time. History reveals that the Egyptians concocted a crude form of grease as early as 1400 B.C. for lubricating their chariot axle wheels. The lubricating materials consisted of partially saponified animal fats and employed plant ashes as a source of potassium carbonate. Processing was undoubtedly carried out on a very crude basis.

A factor which originally contributed a great deal to the grease industry was the work of a French chemist, Chevreul, (1), who in 1823 showed that the process of saponification is a chemical reaction of splitting fat into the alkali salt of fatty acids and glycerine. Many other developments of a technical nature also had a great deal of influence on the industry as a whole: one of these was the introduction of rosin in the soap kettle about 1850, to produce a sett grease. This type grease is no longer a major product but did serve as an adequate lubricant for slow moving bearings.

It was approximately one hundred years ago that grease first appeared on the market employing petroleum oils as the lubricant. These petroleum greases were simple mixtures of lime soap and a lube distillate. Manufacturing equipment usually consisted of a single open kettle with either no agitation or a simple mixing paddle operated by manpower. Heat was supplied from an open wood or coal fire.

Gradually grease manufacture was developed as an art and this state existed until just a relatively few years ago. In fact, most of us can clearly recall when all phases of grease manufacture were classified as a strict art and were known only to a select few. In 1927 one of the first books to go into detail on the formation and manufacture of grease was published (2). Since then there have been several more excellent books published on this subject. To further acquaint the industry with processing progress, a paper was presented to the NLGI convention in 1947 (3) on the subject of "Grease Manufacture—A Science or Art." As more information became available to the equipment manufacturers and design engineers, new and better process equipment was designed especially for this industry to suit its growing needs. This condition exists today.

Present Method of Manufacture

The majority of greases produced today have in common similar process features.

1. Grease is made on a scientific basis.

2. Most plants produce grease batch-wise.

3. Pressure kettles or reactors are now widely employed for the saponification reaction.

4. Some accurate means is employed to measure all the ingredients for making the complete finished product.

5. Usually, a number of paddle kettles are employed to partly or completely finish the products and in a number of plants deaeration, dehydration and milling are used in the final finishing step.

6. Process heating is usually done with steam, hot oil, Dowtherm or by direct fire.

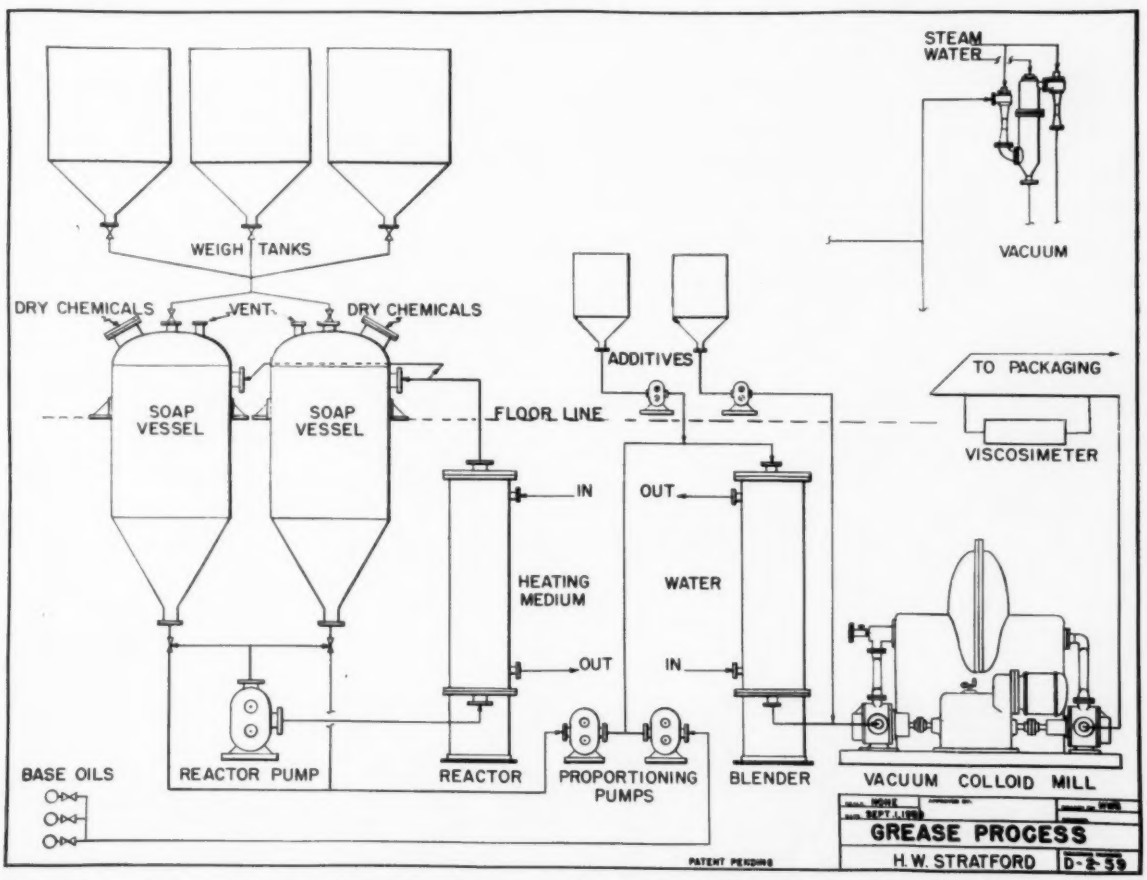
7. Product cooling has been a problem and today is usually achieved by employing cold oil in the final formulation of the grease, aided by some form of heat exchanging.

Forecast of Grease Manufacture

It is improbable that anyone can accurately forecast just what mode will be employed for the future manufacture of lubricating greases. We can extrapolate from the past and present and thereby attempt to make an intelligent projected forecast in regard to the commercial processing of future greases.

The scope of the following discussion is limited to the author's personal beliefs.

The grease plant of the future will be a compact, continuous chemical process, completely instrumented and programmed, so that only an observer will be required for its entire operation. During the interim between the present manufacturing methods and the future continuous process there will be the development of semi-continuous process. The accompanying flow diagram illustrates one such semi-continuous manufacturing method that is designed with the purpose in mind that the majority of the equipment employed could be converted, in the future, to continuous operation. The lack of consistently uniform chemicals, the required processing instrumentation and the required knowledge seem to limit the degree of processing all greases continuously at present.



THE majority of the equipment in this semi-continuous manufacturing method could be converted to continuous operation.

Pilot plant operations have confirmed that this semi-continuous process is rational and sound in view of present chemicals commercially available and the types of greases demanded.

Conventional means are employed for weighing and measuring all materials intended for the formulation of the basic soap. Weigh tanks are illustrated for this service but energy cells, meters or proportioning pumps may be used.

The two pressure soap vessels are used alternately as a charge vessel for the formation batch-wise and a run vessel for the base soap. These vessels are simple vessels designed for pressure or vacuum operation and their size is dependent upon individual plant production requirements. No agitation or heat exchange is incorporated in the reactor other than that supplied by the recycle from the reactor pump.

A variable speed reactor pump recycles all the components that are required to produce the base soap from one of the soap vessels through the reactor. This pump provides all of the energy that is required for the mixing and recycling of the soap charge stocks.

The saponification reactor is designed to promote the proper reaction conditions for the complete chemical saponification of the fats and alkali charged to it from the cursory mix in one of the soap vessels. Only a relatively few passes are required through the reactor to establish both the proper temperature and degree of intimate mix to complete the saponification reaction. The rapid heat transfer and the required mixing is accomplished by establishing an erratic flow pattern through the reactors internal piping and surrounding this flow pattern with a heat exchange medium. The flow velocity of the cursory mix through the reactor is maintained at such a rate by the variable speed reactor pump so that the flow is always in the turbulent range. The result is that the heat transfer rate is excellent and mixing is intimate. Almost any heating medium, such as high pressure or super heated steam, hot oil, Dowtherm or direct fire, may be employed as long as the required temperature may be attained in a reasonably short time. The reaction temperature is regulated and controlled by instruments as demanded for each different soap formulation. The physical size of the saponification reactor is approximately 24 inches OD x 72 inches length for a soap production capacity of more than 3000 lbs per hour.

The base soap produced may either be used for producing finished greases in conventional paddle kettles or be used as a charge stock for the continuous blending and finishing of grease as illustrated on the flow diagram.

Proportioning pumps are used to meter accurately the soap, base oil and additives to a blender where all components are blended into a uniform cursory mix. All proportioning pumps are inter-locked to maintain the correct formula proportions.

Cooling and blending is done in the blender. The blender is very similar in design to the reactor and serves as a cooler and mixer. Energy for the mixing is provided by the blender pump and the turbulent flow pattern maintains a good heat transfer rate even on severe cooling. Cold water or a refrigerant is used as the heat transfer medium in the blender.

After the entire ingredients, to produce a finished grease product, have been uniformly blended and cooled, the stream is charged to a vacuum colloid mill where final homogenization, deaeration, dehydration and controlled milling is performed in a vacuum atmosphere.

A slip stream is taken from the finished product line to a continuous recording viscosimeter and this instrument is used as the control for the flow rates of the proportioning pumps in the blending section.

Conclusion

It is the author's belief that future grease manufacturing for any reasonable volume will be produced in a compact continuous plant and that the majority of process controlling will be done automatically by selected instruments. Laboratory formulation and final control on all products will continue to play an extremely important part in the processing of future grease products.

Bibliography

1. Davidsohn, J.; Better, E. J. and Davidsohn, A.; *Soap Manufacture*, 5, Vol. 1 (1953).
2. Klemgard, E. N., *Lubricating Greases*, (1927).
3. Johnson, C. L.; Altshuler, J. A.; *NLGI Spokesman*, 4, Vol. 9, No. 11 (1949).

About the Author

H. W. Stratford *received his training in mechanical engineering at Stanford university. In* 1940 *he joined Standard of California, working in the research and development department. The following year he became associated with Studebaker at South Bend, Ind. He served as vice-president in charge of research and development for Stratford Engineering Corp. until* 1958. *Mr. Stratford is a consulting engineer, specializing in the processing of lube oils, soap manufacture and grease processing equipment.*

Grease Evaluation by Bearing Performance Tests

By: J. R. Belt and Nathan Glassman
U. S. Naval Engineering Experiment Station
Annapolis, Maryland

NOTE: The opinions or assertions made herein are those of the authors and are not to be construed as official or reflecting the views of the Department of the Navy or the Naval Service at large.

PHOTOS: *Official U. S. Navy Photographs*

Introduction

The practice has become widespread in aeronautical grease specifications to include a high-temperature bearing lubrication requirement defined by a suitable test procedure. Similarly widespread has been the use of functional laboratory-type ball bearing performance tests to provide initial information on the suitability of lubricating greases to adequately lubricate antifriction bearings in actual service.

Commencing some twenty years ago when it was generally accepted that grease procurement in terms of chemical composition could not be relied upon to provide service-satisfactory lubricants, laboratory performance test equipment has been gradually refined and the test temperatures quoted in specifications have risen from 250°F to 450°F. Actually, present explorations of grease performance are being conducted in the 450°F to 700°F range.

The United States Naval Engineering Experiment Station, at the request of the Bureaus of Aeronautics and Ships, Navy Department, has been active in the field of development and use of functional grease ball-bearing performance testers from its inception. The history of the station's contributions to the development and experience of this field is described in the following publications:

Performance Specifications for Greases—by R. C. Adams and H. E. Patten in Proceedings of the ASTM Vol. 41, 1941, pp 1095-1107.

Evaluation of High Temperature Greases—by R. C. Adams and S. M. Collegeman in Journal of the American Society of Naval Engineers, Inc., Vol. 59 No. 1, Feb. 1947, pp 22-32.

Factors Affecting Simulated Tests of Greases—by S. M. Collegeman and J. R. Belt in ASTM Symposium on Functional Tests for Ball Bearing Greases June 23, 1948, STP No. 84, pp 91-101.

The work described in these publications led to the issuance of Method 331.1 of Federal Test Method Standard No. 791: *Performance Characteristics of Lubricating Grease in Antifriction Bearings at Elevated Temperatures.* This method, frequently referred to as

FIGURE 1.

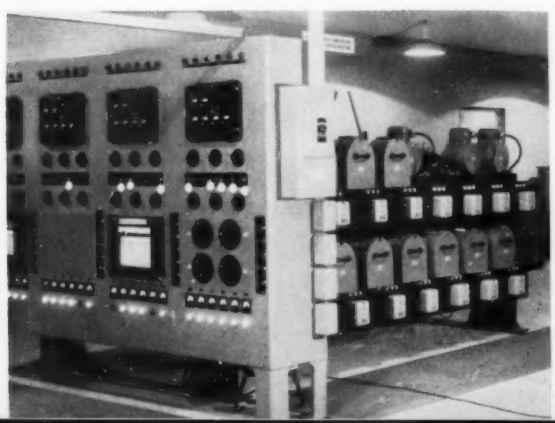
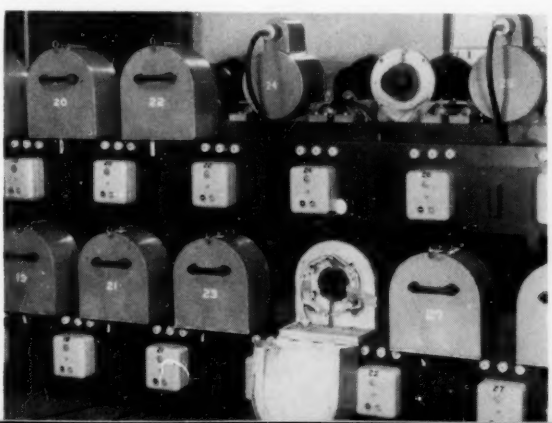


FIGURE 2.



the "Navy tester," is widely quoted in aeronautical grease procurement specifications. It is suitable for temperatures up to 300°F and with a proper choice of bearing and housing metals and slight modification of the housing design suitable for use at 450°F.

It is not intended to imply that the station's has been a solo effort. Consultation with industry—both grease and bearing manufacturing—has been frequent. In 1950 the station was invited to and joined in the effort of the laboratory study panel on high temperature grease testers of the CRC airframe lubricants group. The objective of this panel is to develop techniques to predict the high temperature performance, in actual service, of airframe and accessory lubricants. The initial work of the panel was to develop a technique for evaluating greases in antifriction bearings at speeds up to 10,000 rpm and at temperatures from 400°F to 500°F, with no appreciable load applied. This work resulted in the issuance of CRC Method L-35, a *Research Technique for the Determination of Performance Characteristics of Lubricating Greases in Antifriction Bearings at Elevated Temperatures*. This test technique is suitable for test temperatures up to 450°F. It permits the use of three different tester designs, one of which is based upon Federal Test Method 331.1, constructed of suitable heat resistant materials and with a housing design to insure minimum loss of grease from the vicinity of the bearing, which is a special tool steel bearing. Present work of the CRC group on high temperature grease tests is concerned with extending tester range to 700°F and to designing a test for evaluating high temperature greases under heavy loads.

Station Experiences with Federal Test Method 331.1—The Navy Tester

The Navy tester was originally designed to provide adjustable control of four variables: temperature, speed, bearing size and bearing load. It was intended to provide temperatures up to 500°F, speeds up to 20,000 rpm, bearing sizes up to 60 mm bore, and radial bearing loads up to 50 lb. Because of customer demand as outlined in numerous grease specifications the major use of this tester was confined to the temperature range of 250°F to 300°F, bearing speed of 10,000 rpm, bearing size 204, and radial loads of 3 pounds. In order to obtain in a reasonable time sufficient replicate runs on a grease to determine its average performance, thirty test units were installed. Two views of the assembly are shown in Figures 1 and 2.

A single unit of this apparatus consists essentially of a precision machined and hardened spindle supported in a cast-iron pedestal by two ball bearings. The test bearing (204K Conrad Type) (ABEC-Grade 1) is packed by hand with 3.0±0.1 gm of grease, placed in a close fitting housing and is held on the end of the spindle by a light press fit. A spindle with its three bearings and test bearing housing is shown in Figures 3 and 4.

A ½-hp motor belted to the spindle by suitable pulleys drives it at 10,000 rpm. The motor is hinged to the underside of the pedestal so that constant belt tension is maintained. Radial loads of three pounds are applied by suspending weights from the bearing housing, while a five pound thrust load is applied by a spring compressed against the face of the test bearing housing. The test bearing and its housing are in the oven and surrounded by heaters to provide the indicated temperatures. Temperature is measured and controlled by automatic instruments sensing through thermocouples pressed against the outer race of the test bearing. Heated air in the oven is kept evenly distributed by means of a spinner disk fitted on the spindle just behind the

FIGURE 3—A side view of the Navy tester spindle.

FIGURE 4—End view of spindle with test bearing in housing.

test bearing housing. The test is run continuously on a daily cycle of 21½ hours running and 2½ hours shutdown.

Failure of lubrication is considered to have occurred when any of the following arise:

a. Tripping of motor thermal cut-out switch indicating that fractional torque has increased sufficiently to overload the motor.

b. Locking of test bearing and belt slippage at start of daily test cycle.

c. Excessive leakage evidenced by flow of grease or oil down the face of the test bearing housing.

d. Excessive noise (squealing) for more than two hours.

It is generally the case that failures below 300°F show an incidence of cage breakage while those above this temperature have an incidence of hardened grease or dry rough bearings. The foregoing is a description of the set-up and its operation as described in Federal Test Method 331.1. Normally four tests are made on a grease, and the arithmetical average of these runs is required to be equal to or greater than the number of hours specified. Occasionally additional determinations are made when the pattern of results obtained in four runs is erratic. These additional runs are added to the other runs and an average based on all runs reported, unless a physical reason has been uncovered for discarding any of the runs.

When the unit is used at temperatures above 300°F and up to 450°F as required by the CRC L-35 procedure, which is now specified in Specifications MIL-G-25760(USAF)(350°F) and MIL-G-0025013B(ASG) (450°F), the procedure of Federal Test Method 331.1 is used except that the test bearing is tool steel with silver-plated copper-beryllium retainers (MRC204-S-17) (ABEC-Grade 3) and the housing is 18-4-1 tool steel designed to minimize grease loss from the bearing area. The bearing is lubricated with 3.2±0.1 ml of test grease and a test cycle of twenty hours running time and four hours shutdown is used. While the L-35 technique specifies four cycles per week with a 72-hour shutdown over the week-ends, normally we conduct the test on a seven-cycle per week basis. This is because of the demand for information from the testers and because no clear picture of difference between a four-cycle and seven-cycle per week test has been demonstrated.

The station's experience in the past five years in testing greases submitted under various aeronautical specifications over the temperature range 250°F to 450°F using Federal Test Method 331.1 and its modification as developed in CRC Method L-35 is shown in Figure 5. An index to the severity of this type of test is gained by examining the totals. Of 125 greases tested, 32 failed to meet the minimum average life of the required specifications. This is a failure rate of approximately 25 per cent. For two classes of greases where the temperatures

GREASE TYPE	TEST TEMP °F	MINIMUM AVERAGE LIFE REQUIRED	NUMBER OF GREASES TESTED	NUMBER OF PASSING GREASES	NUMBER OF FAILING GREASES	NUMBER REQUIRING MORE THAN FOUR TESTS	BASED ON 4 TESTS		
							NO. WITH 3 OR MORE TESTS OVER MINIMUM REQUIRED LIFE	NO. WITH 3 OR MORE TESTS UNDER MINIMUM REQUIRED LIFE	NO. WITH EQUAL NO. OF PASS OR FAIL TESTS
MIL-G-3278	250	1000	50	39	11	3	34	8	5
MIL-G-3278A	250	1000	17	15	2	3	13	1	0
MIL-L-7711	250	1000	9	7	2	1	5	2	1
MIL-G-7118	250	1000	7	6	1	1	4	0	2
MIL-G-7421 & 21A	250	650	2	1	1	1	1	0	0
MIL-G-21164 (AER)	250	1000	1	1	0	0	1	0	0
MIL-L-3545	300	600	22	15	7	2	10	6	4
MIL-G-25760(USAF)	350	400	2	2	0	0	2	0	0
MIL-G-25013A	450	300	15	7	8	4	5	6	0
TOTALS			125	93	32	15	75	23	12

FIGURE 5.

are elevated, MIL-L-3545 (300°F) and MIL-G-25013A (450°F) the failure rate is approximately 50 per cent. Only 15 cases in 125 occurred where more than four tests were considered necessary to reach a clear decision as to pass or fail (12 per cent). In 75 of the 125 cases three or more of the four tests conducted exceeded the minimum average life required of the grease (60 per cent); 23 of the 125 cases had three or more of the four tests conducted below the minimum average life (18 per cent); only 12 of the 125 cases had an equal number of bearings above and below the minimum required average life of the greases (10 per cent). These data suggest that greater insurance could be obtained in using the data from this type of test by a requirement that at least three of four test bearings exceed the minimum average life required by the applicable specification. Such an action would have an overall effect of eliminating 40 per cent of the greases in Figure 5 rather than the 25 per cent eliminated by present practice of taking an average of all test results irrespective of their individual relationship to the minimum life requirement of the specification. Such practice would have a more trenchant effect on the high temperature grease specifications MIL-L-3545 and MIL-G-25013A but reliability in these greases is more critical considering the temperature extremes at which they are required to function.

An Experiment to Measure Tester Reliability

When discussing the reliability of greases as defined by functional laboratory performance testers, one must consider the repeatibility or the reliability of the test device. While many experiments can be conjectured, the ability to carry them out, even when 30 test units are available, can be frustrated by priority work-loads that occupy all the testers almost continuously. For, in addition to the 125 greases tested against various specifications in the past five years, the testers have been equally busy defining the effects of storage or nuclear irradiation on the bearing performance life of greases and other studies relating to the effect of environment on grease life. However, one experiment was carried

out over a period of approximately seven months. It consisted of running a purchased sample of an approved MIL-L-3545 grease at 300°F in each of the 30 testers as they became available. A single lot of bearings was obtained and carefully measured for bore and outer race diameter, radial and end play, and noise level. The test spindles also were carefully measured and extreme care was exercised to insure proper lubrication of bearings and mounting in the tester. The results obtained are shown in Figure 6. They are presented in the order in which started. Values marked with a single asterisk indicate bearing ball retainer broken; those marked with a double asterisk had no grease visible in the bearing or housing area at the end of the test. All other values were characterized by either rough or frozen bearings and grease still present being hard and/or dry. The grease showed a life ranging from 106 hours to 1433 hours. The average of the 30 runs was 808 hours and 80 per cent of the bearings exceeded the required minimum average life of 600 hours. When the first 28 runs were divided up into groups of four and

RUN No.	DATE START OF RUN	HOURS TO FAILURE	AVERAGE OF FOUR RUNS	NUMBER OF RUNS ABOVE MINIMUM REQUIRED LIFE	RUN No.	DATE START OF RUN	HOURS TO FAILURE	AVERAGE OF FOUR RUNS	NUMBER OF RUNS ABOVE MINIMUM REQUIRED LIFE
1	4-18-56	1335			17	8-15-56	792		
2	6-13-56	715			18	8-15-56	620		
3	6-14-56	750			19	8-15-56	1163		
4	6-25-56	257	764	3	20	9-26-56	656*	808	4
5	7-16-56	1051			21	10- 9-56	944**		
6	7-16-56	796			22	10-23-56	1014		
7	7-19-56	862			23	10-23-56	685		
8	7-19-56	480	797	3	24	10-24-56	1223**	967	4
9	7-19-56	1249			25	10-25-56	902		
10	8-14-56	941			26	11- 2-56	929		
11	8-14-56	626			27	11- 7-56	546		
12	8-14-56	106**	731	3	28	11- 7-56	489	717	2
13	8-14-56	163**			29	11-21-56	684		1
14	8-14-56	922			30	11-21-56	1433		1
15	8-15-56	866			TOTALS		24244		24(80%)
16	8-15-56	1045	749	3	AVERAGE		808		

FIGURE 6—Results of 30 tests on a single grease sample at 300° F., using the Navy design tester.

the average lives of the groups calculated, all seven groups of four exceeded the required minimum average life of 600 hours. These averages ranged from 717 to 967 hours and consisted in all cases but one of at least three bearings exceeding the 600 hour minimum life. In one case two bearings were below and two were above the required minimum 600 hour value.

Attempts to correlate the lives obtained with the various measurements of bearing and shaft fits or with the type of failure occurring (only three of the bearings had broken cages, the remainder were frozen or rough) have not shown anything of significance. Thus, while unexplained variables can affect the tester's performance, its value as a screening device for obviously poor lubricating greases is unimpaired. In this connection it is of interest to compare the average of the 30 runs on the purchased sample of grease with that obtained with two sets of four runs made on the original qualification sample in 1951-2 in Figure 7.

HOURS TO FAILURE			
30 RUN SAMPLE	QUALIFICATION SAMPLE		
YEAR: 1956		1951	1952
RANGE: 106 – 1433	RUN 1	1335	838
	RUN 2	1051	982
	RUN 3	683	967
	RUN 4	558	688
MEAN HRS. 808		907	869
NO. OF BEARINGS OVER 600 HRS.: 24	7		

FIGURE 7—Comparison of the performance of purchased and original qualified samples of grease in the Navy tester.

A Comparison of Two Types of High Temperature Grease Performance Testers

Specifications MIL-G-0025013B(ASG) and MIL-G-25760 (USAF) require conduct of the bearing performance test using CRC Method L-35. The latter method permits a choice of three different tester designs, the Navy tester, one of a Texas company design, and an ABEC-NLGI design. The Texas design is manufactured by the Pope Machinery corporation of Haverhill, Mass., who incidentally also are the manufacturers of the shafts for the Navy tester. Without going into great detail the "Texas" design differs from the Federal Test Method 331.1 tester primarily in that the test bearing is inside a rigid housing which holds it and the single back support bearing in alignment. The Method 331.1 spindle has the test bearing in a housing outboard to two support bearings which hold the shaft. A comparison can be made of the spindle, bearing and housings of the Federal Test Method design, Figures 3 and 4 and the Texas design in Figures 8 and 9.

A study to determine the precision advantages of these testers and the other design permitted in CRC Method L-35 has been undertaken by the CRC high temperature tester panel. While the data collected on

FIGURE 8—A side view of the Texas design grease tester.

two study greases RLG-204-52 (a non-soap thickened silicone grease) and RLG-205-52 (a copper phthalocyanine thickened silicone grease) suggest that the Texas spindle is more precise, the significance of either tester is unknown and the results obtained on these two greases are not sufficient to say how the testers are related to each other. Because of a large capital investment in test units and a considerable experience backlog in their use, there is a natural reluctance to make a complete change based on the results of test of two greases.

FIGURE 9—End view of Texas unit, test bearing in housing.

In August, 1956, the Bureau of Aeronautics asked the station to develop a potentiality to conduct grease tests at up to 1000°F. A review of the state of the art and the activities of the CRC panel indicated that the most available piece of equipment on which some experience was already being accumulated was a modified Texas tester manufactured by Pope Machinery corporation. This was constructed of vanadium alloy tool steel and was considered suitable for use up to at least 750°F. Four spindle assemblies (Pope Drawing P1911-HT-A) and mounting brackets were procured, and ovens to provide the needed temperatures were built. The units were instrumented as the Navy tester has been and tests were undertaken.

The availability of these units at the station permitted the undertaking of an experiment to determine whether the Navy and Texas design testers would give similar or different results when employed by personnel of one laboratory. Also because a larger number of

HOURS TO FAILURE			
YEAR	1953	1954-5	1958-9
CYCLES PER WEEK	7	4	7
GREASE: RLG-204-52			
RUN No. 1	320	77	118
RUN No. 2	190	478	977
RUN No. 3	92	712	682
RUN No. 4	218	318	444+
RUN No. 5	—	149	444+
MEAN, HOURS	205	347	533+
GREASE: RLG-205-52			
RUN No. 1	423	273	378
RUN No. 2	343	301	340
RUN No. 3	410	320	200
RUN No. 4	415	360	202
RUN No. 5	—	399	—
MEAN, HOURS	398	331	280

FIGURE 10—Navy unit data on CRC study greases at 450° F.

greases suitable for use at 450°F. were becoming available, an opportunity to develop a relationship between the testers presented itself. Such relationship, if determined, might obviate the need to abandon a battery of otherwise useful test units.

In the studies conducted to date, three greases have been under test using CRC Method L-35 except that seven cycles/week are employed. These are retained samples of RLG-204-52 and RLG-205-52 and a proprietary grease submitted for test under Specification MIL-G-25013A. Test temperature is 450°F. To insure that no change had occurred in the two CRC study greases their performance in the Navy tester was repeated. This represented the third time these greases were so studied and the data obtained at three intervals over a period of five years is worth presenting both as a further measure of Navy tester repeatibility and of study grease change with time. These data are shown in Figure 10. (Values followed by a plus sign indicate test run not yet completed.)

The data in Figure 10 suggest that RLG-204-52 is improving with age, although at least one short run is

HOURS TO FAILURE			
GREASE	RLG-204-52	RLG-205-52	PROPRIETARY PRODUCT
TEXAS DESIGN			
RUN No. 1	938	670	418
RUN No. 2	935	689	304
RUN No. 3	350	473	484
RUN No. 4	523	457	423
RUN No. 5	688+	—	474
MEAN, HOURS	687+	572	421
NAVY DESIGN			
RUN No. 1	118	378	236
RUN No. 2	977	340	242
RUN No. 3	682	200	260
RUN No. 4	444+	202	465
RUN No. 5	444+	—	440
RUN No. 6	—	—	450
RUN No. 7	—	—	377
RUN No. 8	—	—	553
MEAN, HOURS	533+	280	378

FIGURE 11—Performance of three greases in the Navy and Texas design testers, using CRC Method L-35 at 450° F.

obtained in each group of data. RLG-205-52 may be worsening although all the groups of data lie in a band between 200 and 415 hours.

The results of test of the two CRC study greases and the proprietary grease in the Navy and Texas design testers using CRC Method L-35 at 450°F are shown in Figure 11. A comparison of the means indicates that the Navy tester is more severe for these three greases. However, these results do not suggest that a simple relationship exists between the testers. It is planned to explore this further as time permits.

As a result of the 450°F performance lives obtained on three products recently tested under MIL-G-25013A, it is becoming highly questionable whether it is profitable now to pursue tester refinement at 450°F to insure that marginal greases are not unfairly excluded. The performance of these latter greases in the Navy tester using CRC Method L-35 is shown in Figure 12.

The performance of these greases is so good at 450°F that, unless they have given away some other desired specification property to achieve this outstanding performance, it would appear that attaining bearing lives of 500 hours and more at 450°F is no longer a dream of the future.

HOURS TO FAILURE					
GREASE:	A		B		C
	SET 1	SET 2	SPLE. 1	SPLE. 2	
RUN 1	661+	1204	837	1590	601
RUN 2	642+	608	821	919	473
RUN 3	554+	758	1179	758	603
RUN 4	525	708	1145	480	681+
MEAN:	594+	820	996	937	590+

FIGURE 12—Performance of three proprietary greases in the Navy design tester, using CRC Method L-35 at 450° F.

Some Tests Above 450°F

Preliminary trials up to 700°F have been made with greases A and B Figure 12. The results are shown in Figure 13.

HOURS TO FAILURE			
Temperature	450°F	600°F	700°F
Tester	Navy	Texas	Texas
Grease A	820 (4 Runs)	53 (1 Run)	5 (1 Run)
Grease B	937 (4 Runs)	13 (1 Run)	2 (1 Run)

Figure 13. Test Results Up to 700°F

More tests will be conducted, but the limitation of available greases suitable for testing again is cropping up as the temperature level is raised.

Conclusions

A great many numbers have been shown in this report. This has been done deliberately because performance data of greases in functional testers is a generally scarce item. This is because this type of testing is expensive and time consuming. It is hoped that you will study these data and accept our invitation to make suggested improvements in test procedure and grease evaluation. It appears that the end of the story of grease life versus performance tester versus service behavior is not yet in sight.

J. R. Belt *received a BS degree from Johns Hopkins university in* 1943. *Head of the fuels and lubricants division at the U. S. Naval Engineering Experiment Station, Annapolis, he has worked for the Navy's Bureau of Ships and Aeronautics since* 1946.

About the Authors

Nathan Glassman *received his BS degree in chemistry from the City College of New York and did graduate work in chemistry at the University of Maryland. With the exception of military service and a brief tour at the Aeronautical Standards Group, Bureau of Aeronautics, Washington, D.C., Mr. Glassman has been working at the U. S. Naval Engineering Experiment Station at Annapolis, Md. He is head of the composition branch of the fuels and lubricants division at the station, where he has been engaged primarily in the development of material specifications for fuels and lubricants.*

GREASE CONTAINERS: Past, Present and Future

By W. R. Hosler
Battenfeld Grease & Oil Corp., Inc.

IF THERE is a company here represented which ignores and continues to ignore planned progressive packages and packaging, this company will cease to prosper and exist in our field of manufacturing and packaging of lubricants.

In order to place grease packages in the proper perspective dollarwise, attention is called to this pie chart based on an average of all popular grease containers currently in use today. Twenty-eight percent of the grease sales dollar is spent on the container, and 72 percent for all other items including raw materials, marking and filling, manufacturing, overhead and profit.

The cost of the grease package is a major factor in the total cost of doing business.

In order to present a comprehensive picture of grease containers; past, present and future, it is necessary to review both containers and grease requirements in the early days of grease manufacturing.

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

There were, basically, three type packages available for carrying and protecting the product from the manufacturer to the consumer.

Both the type lubricant and the physical design of the equipment actually set the pattern for grease container requirements. The grease was cup and axle; the equipment design for accepting the lubricant was cup and open and housed.

Wooden barrels were the accepted large package. These containers were formed by wooden staves held together on the sides by metal bands. The top and bottom were solid wooden discs. Normally, the three sizes used would net at 400, 200 and 100 pounds.

Straight sided small metal cans and one pound wooden boxes were the accepted small packages. The metal cans ranged in size from one to fifty pounds and were contained in nailed wooden boxes. The size, shape and openings varied from the short squat can to the tall can with lesser diameter, with the slip cover full opening as the popular closure.

During this period the flaring pail was introduced in three sizes; ten, fifteen and 25-pound. This package was larger at the top than at the bottom, providing nesting qualities when empty and attractiveness as a reusable container.

In review, the three type packages were:

> Wooden barrels (100, 200 and 400-pound sizes), small metal straight sided containers (1, 2, 3, 5, 7, 10, 12, 15, 25, and 50-pound), small metal flaring containers (ten, fifteen and 25-pound).

This was the era in our industry between the improvised lubricants created and produced by the user, and the marketing of branded products.

The consumer at this time was not particularly interested in the brand name, package appeal, or specific specification of the lubricant. He was primarily interested in a quantity of basic product. It was only necessary to package and protect in transit a basic grease in the quantity desired.

This concludes the popular grease packages of the early days. However, it does not necessarily conclude the packages used, as some of these are available in whole or part today.

The next era is that of branded products.

The desire of branded marketing was created by the ability of the manufacturer and distributor to produce more grease than consumed. This condition presented a problem of choice to the consumer.

This same condition made new demands on the packages required for the grease packaging industry. It must not only protect the contents from the manufacturer to the consumer, but has the added responsibility of being chosen above competitive grease packages.

As industrial design engineers improved equipment, manufacturers of grease improved their products. Again, new demands were made on the grease container, and it was necessary to develop specific containers for a specific type grease and application.

A great variety of grease packages began to appear on the market.

Small containers for each type lubricant were common. This required individual nomenclature and instruction. The basic small sizes available then were in the full friction design, straight sided, folded side

seam. The small packages were generally cased in corrugated regular slotted shipping cartons.

The ten, fifteen and 25-pound flaring pail had partially been replaced by three packages; the 10-pound full friction straight sided can, cased, the 25-pound full friction straight sided can, cased, and the 25-pound straight sided steel lug covered pail. Attractive lithographed designs were available in all small size packages. These were generally the blank panel variety having areas for specific nomenclature and directions.

During the branded marketing era, the wooden barrels were being replaced by steel drums, ranging in size from the 14½ to 65-gallon size. The openings were of three basic types; tight head (2 inch x ¾ inch bung), nine-inch (bolt seal or friction cover), full open head (ring seal).

As the grease manufacturing industry and industrial designs required new greases and fittings, the grease packaging engineers were presented a problem of a suitable container for greater ease of use.

The 100-pound drum filled this requirement. It was metal, straight sided, attractively lithographed and could accept dispensing equipment. Again the opening closure varied.

Special follower plates became available for small and intermediate size packages. Special gun filling lugs began to appear. Steel drums were available in fifteen sizes; 14½ gal., 15, 20, 25, 30, 33, 35, 40, 45, 48, 50, 55, 58, 60 and 65. Most of these packages, while standardized in net contents, varied dimensionally. Specialty packages and re-use containers, designed specifically for use other than grease packages, are not included as grease containers, such as cream pails, pressure cookers, chicken waterers, picnic baskets, etc.

The development and acceptance of multi-purpose greases made possible some desired standardization of grease containers.

A number of organizations have worked toward elimination of sizes and creation of dimensional standards. Many grease packages adopted and used have become partially extinct from incapabilities of either manufacturing, filling, closing, shipping or lack of acceptance by the consumer.

As new packages were introduced presenting possibilities of standardization and economies, the common sense and judgment of both the manufacturer and consumer either adopted or rejected these containers. Two replacements offering standardization and economies are the 35-pound straight sided lug covered pail and the 120-pound full open head grease drum.

The following is a list of grease packages for which standards have been established:

One-pound multiple friction
Five-pound multiple friction
Five-pound full friction
Five-gallon lug covered universal pail
120-pound 16 gallon, full removable head lug cover universal drum
400-pound 55 gallon, full removable head universal drum

Factors working toward standardization are: industry organizations primarily interested in package improvement, economies, and standardization, both volume and dimensional.

Container filling and closing equipment manufacturers are interested in standardization for economies of inventory and design. There are a number of industries and organizations, both American and foreign, interested in standardization, and they are doing something toward accomplishing their purpose. Standardization is beyond the talking stage and into the action stage. Our industry can well be proud of this progress.

When planned packaging offers protection, economy, consumer's convenience and package appeal, it can well change the buying habits of the consumer. The development of a new package must be laboratory tested under all conditions, field tested for consumer reaction, accepted by association manufacturers of accompanying equipment and economically pack-

aged. Failure to recognize packages making this type of contribution will result in loss of sale and recognition in the industry.

More recent developments in grease packages are cartridges, plastic collapsible tubes and plastic bags. The success of these relatively new packages is in direct proportion to their ability to meet the ideal packaging standards.

As these packages are developed and accepted, standardizations are in progress before a multitude of manufacturers tailor the package to existing equipment rather than a universal standard. This is not only planned packaging, but planned standardized packaging. Our industry can project its future packages in identical trend of other consumer products more advanced in the field of packages than lubricants.

Accelerated use and acceptance of unit packages more convenient for exact quantity fill, ease of application, and prevention of contamination, are some of the clues for future grease packaging. Movement of our products between manufacturer and consumer may stop at more convenient intermediate filling and packaging operations in collapsible tanks delivered by water, land, or both.

New combinations of plastics, papers, metals, and combinations of one or all will be materials for accepted grease packages. There must be discretion in selection and use of plastics for each individual requirement. Polyethylenes, polystyrenes, polyvinyls, and other plastics with specific brand names vary in their abilities to contain lubricants as much as the lubricants vary within themselves.

Plastics will become increasingly popular for use with current standards in the realm of fittings, handles, liners and coatings.

Developments in the fibre container industries offer future possibilities for grease packaging due to economies in both the package and shipping weight.

Future trends in steel are toward lighter gauges, with current standards in the realm of fittings, handles, offering adequate strength for protecting and delivering the product. The lighter gauge trend is in the 35 pound lug, 120 pound and 400 pound grease drum. These changes will come about by a series of laboratory testing, field testing, trial shipment permits, and approvals.

The packaging engineers of the petroleum industry have the ability and foresight to improve and economically reduce our package costs through planned progressive packaging and continued standardization.

Coordination of the technical advances constantly being made, and full utilization of the abilities and efforts of the packaging engineers, will materially aid the entire lubrication field.

Let's give planned progressive packaging of our products the important place it deserves in our overall progress picture.

About the Author

W. R. Hosler *has been associated with Battenfeld Grease & Oil Corp., Inc. of Kansas City since* 1940, *with the exception of three years with the United States Marine Corps. Named purchasing agent in* 1948, *he assumed the additional responsibility of package coordinator two years later. Mr. Hosler participated in many of the pioneer ventures dealing with the lubricating grease cartridge during its introduction and has since become a recognized authority in the industry on various container developments.*

Literature and Patent Abstracts

Composition

Precipitated Oil-Miscible Soaps As Thickeners for Lubricating Fluids

Allison (U.S. Patent 2,899,389, assigned to Leffingwell Chemical company) suggests that a water insoluble soap be formed from a polycarboxylic acid alkali soap by precipitation and a soap of a second acid be precipitated directly on the first soap. The polycarboxylic soap should be present to the extent of one to twenty per cent of the total and the second soap should be formed from a monocarboxylic acid. The metal salts used to form the two soaps may be the same or different.

For example, 800 pounds of fish stearic acid and 9 pounds of 2-ethylhexoic acid were saponified with a solution containing 176 pounds of sodium hydroxide. A solution of 502 pounds of aluminum sulfate was then added to the above soap solution to form an aluminum soap. Twenty pounds of dimer acid were separately saponified with a solution of 4 pounds of caustic soda after which the dimer acid soap solution was pumped into the mixture containing the aluminum soap and excess aluminum sulfate. The composite soap precipitate was then filtered, water washed, dried and ground to provide a thickener which could be used to form lubricating greases.

In another case an aluminum monomer soap was precipitated on a calcium dimer soap.

Inorganic Thickened Lubricating Greases

In British Patent 812,060, assigned to Continental Oil company, Bergen and Woods describe the formation of colloidal calcium carbonate as a thickener for lubricating oil. First, a mixture of 460 pounds of calcium oxide and 2,000 pounds of methanol was treated with hydrogen sulfide for five and one-half hours to give a

FATTY ACIDS by A. GROSS provide

- Controlled fatty acid radical content
- Controlled purity content
- Ease of saponification
- Resistance to oxidation
- Shipment to shipment uniformity
- Light color

GROCO 8 DISTILLED RED OIL

Titre	8°-10°C
Titre	46.4°-50.0°F
Color 1" Lovibond Red	1 max.
Color 1" Lovibond Yellow	10 max.
Unsaponifiable	1.5% max.
Saponification Value	198-203
Acid Value	197-202
% F.F.A. as Oleic Acid	99 min.
Iodine Value (WIJS)	92 max.
Refractive Index 50°C (Average)	1.4495

ALWAYS MEASURABLY BETTER THAN THE SPECIFICATIONS CALL FOR

COMPOSITION

Myristic Acid	5%
Palmitic Acid	6%
Stearic Acid	2%
Oleic Acid	77%
Linoleic Acid	9%
Linolenic Acid	1%

a. gross & COMPANY

295 Madison Ave., N. Y. 17, N. Y.
Factory: Newark, New Jersey
Distributors in principal cities
Manufacturers since 1837

Write for new edition of the free brochure, "Fatty Acids in Modern Industry."

solution of calcium hydrogen sulfide. After filtering, 200 parts of this solution were mixed with 75 parts of neutral oil and 250 parts of a 23 per cent solution of polydodecylbenzenesulfonic acid in naptha. Carbon dioxide was passed through this mixture for four hours while during the first half hour 175 parts of benzene were added to reduce the viscosity. This gave a colloidal dispersion of calcium carbonate which was then freed of benzene and methanol at 150°C. To 25.2 parts of this calcium carbonate dispersion were added 147 parts of neutral oil and 6 parts of Pluroxin E-231 dissolved in 32 parts of acetone and 140 parts of benzene. After heating this mixture to 150°C. and agitating a lubricating grease was formed which had a penetration of 310 and which did not melt at 428°F.

Stopcock Lubricants

Lubricating greases which are suitable for use on ground joints and vacuum stopcocks are described by Keunecke in German Patent 1,005,-226 (assigned to Laybold-Hochvakuum-Anlagen). These consist of hydrocarbons, with molecular weights above 600, thickened with lithium soaps. Thus a petroleum fraction with a mean molecular weight of 450 was distilled under vacuum at 240°C. to give a residue having a mean molecular weight of 760. To 100 parts of this residue were added 20 parts of lithium stearate and the mass was heated in a vacuum to 230°C. After cooling, this lubricant was milled to give the stopcock lubricating grease. Silicone fluids, fine silica, molybdenum disulfide, etc., may also be included in such compositions.

Launching Grease

Blowers, Hodge and Sayer in British Patent 804,252 (assigned to Esso Research and Engineering company) state that the addition of microcrystalline wax improves way greases for ship launching. A suitable composition consists of 50 per cent paraffin wax with a melting point of 135 to 140°F., 20 per cent of microcrystalline wax having a melting point of 150 to 160°F., 20 per cent of petrolatum and 10 per cent of wood rosin.

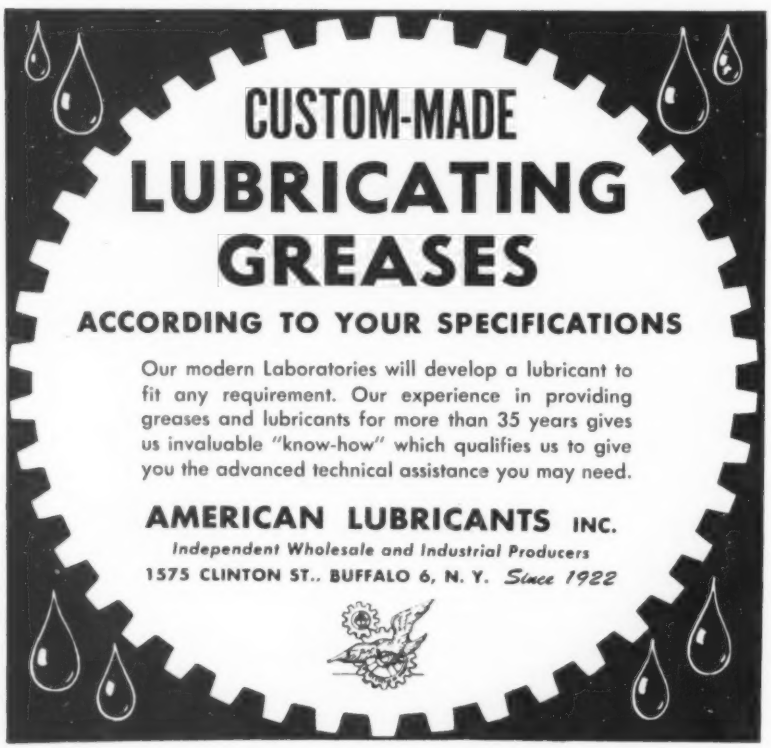
High Temperature Lubricating Grease Containing Free Metal Base and Silicone Polymer

Lubricating greases are described which will effectively lubricate bearings operating at high temperatures (350°F.) and will not melt or lose consistency at such operating temperatures. While Zajac and Swenson in U.S. Patent 2,911,369, assigned to Standard Oil company (Indiana), mencion the use of alkali metal soaps or alkaline earth metal soaps as thickeners, lithium 12-hydroxy stearate seems to be preferred.

The major portion of the lubricating fluid may be either a petroleum oil or a synthetic oil. However, 0.5 to 10 per cent of a liquid silicone polymer should be present in the composition and 3 to 500 per cent, based on the metal soap content, of a free basic compound. This latter compound is selected from the group consisting of an alkali metal hydroxide, an alkali metal oxide, an alkaline earth hydroxide or an alkaline earth oxide.

The suggested lubricants are prepared by mixing the soap constituents, the silicone fluid, all of the base dispersed in water and a portion of the lubricating oil. The mixture is slowly heated to about 212° F. and held at this temperature until most of the water has left. The remainder of the oil is then added and the batch is heated to 500 to 510°F. until the reaction is complete. The mass is then cooled after which it can be homogenized if wished.

One such product contained 7.0 per cent lithium 12-hydroxy stearate, 0.75 per cent lithium hydroxide, 1.5 per cent DC 550 fluid and 90.75 per cent of an oil having a viscosity of 813 SUS at 100°F. This had a worked penetration of 320 and a dropping point above 450°F. On a hot plate there was no change at 700°F.


CUSTOM-MADE
LUBRICATING
GREASES
ACCORDING TO YOUR SPECIFICATIONS
Our modern Laboratories will develop a lubricant to fit any requirement. Our experience in providing greases and lubricants for more than 35 years gives us invaluable "know-how" which qualifies us to give you the advanced technical assistance you may need.
AMERICAN LUBRICANTS INC.
Independent Wholesale and Industrial Producers
1575 CLINTON ST., BUFFALO 6, N. Y. Since 1922

Wood Preservative Grease

A grease-like product which if applied to wood poles, posts, etc., at ground level will reduce the possibility of further rot and thus extend the life of the wood, is suggested. This consists of at least 2 per cent of pentachlorophenol, 50 to 95 per cent of a mineral oil solvent for the pentachlorophenol, and sufficient dicetyldimethyl ammonium bentonite to thicken the fluid to a grease consistency. From 0.5 to 5 per cent of an organic polar solvent such as methanol may also be included.

Behr (U.S. Patent 2,904,467, assigned to Chapman Chemical Co.) states that the material may be applied by hand spreading, by a mechanical grease gun, or on a paper or plastic film or bandage. A variety of examples of suitable compositions are given and in some of these the thickener consists in part of fine silica. In others wood preservatives such as zinc or copper naphthenate are used. While most examples indicate the use of aromatic HB oil, mineral spirits and diesel oil are also used. Still other compositions contain coal tar creosote as the fluid. Likewise, inorganic fungicides such as sodium, potassium or ammonium fluorides may be included in the mixtures.

Characteristics

Dimethyldioctadecyl Ammonium Bentonite as a Thickener for Automotive and Artillery Grease. Max T. Fisher Rock Island Arsenal, May 1959, 36 page, PB 142, 109.

Better heat stability, availability and uniformity are advantages of certain non-soap thickeners over conventional soap thickeners for greases. The elimination of a major defect, poor salt spray corrosion resistance, without adversely affecting other properties, could result in a less critical and possibly superior grease meeting Specification MIL-G-10924A. Of the resins, polymers, silicas and clay materials screened, two dimethyldioctadecyl ammonium bentonites yielded greases that most nearly met the requirements of the specification. Fatty acid esters

HARCHEM
2-SL
BASIS FOR THE SOLUTION TO LOW AND HIGH TEMPERATURE LUBE PROBLEMS
Harchem 2-SL is a synthetic lubricant base that meets Mil-L-7808 specifications. For the lubrication of jet aircraft, missiles and their instruments, electrical systems and servomechanisms, 2-SL assures viscosity stability through temperature ranges from -65°F to 347°F. Excellent compatibility with oxidation inhibitors, minimum corrosivity and high load carrying ability are also characteristics of this lubricant base. Requests for further information will be promptly answered.
WRITE FOR BULLETIN OR CONSULT
CHEMICAL MATERIALS CATALOG PAGES 173-175
THE KEY TO
HARCHEM
BETTER PLASTICS
HARCHEM DIVISION
WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

of sorbitol, lauroyl and stearoyl sarcasines, and a barium sulfonate were incorporated in the bentonite greases at various concentrations and their effect on salt spray resistance and other properties were determined. Sorbitan monooleate and stearoyl sarcosine in 1.5 per cent concentration were effective salt spray corrosion inhibitors in the bentonite greases formulated and have little adverse effect on their structural stability. It was found, however, that storage at low relative humidity and the resulting loss of water of composition caused severe shear breakdown of these greases. Since no suitable substitute has been found for water for stabilizing dimethyldioctadecyl ammonium bentonite grease of the MIL-G-10924A type, storage or use in arid environments would be inadvisable.

SIGN OF
CORRECT
LUBRICATION

Mobil

Makers and Marketers of
Mobil
Automotive
Products

Mobil
Industrial
Oils and Greases

150 E. 42nd STREET
NEW YORK 17, N. Y.

Characteristics of Lubricating Greases Containing Synthetic Fluids

Lubrication (Texaco, Inc.) for November, 1959 is devoted to synthetic lubricating fluids. The latter part of this issue, about six pages, mentions lubricating greases in which certain of these synthetics are used.

Mention is made of the fact that only the diesters, polyesters, complex esters and silicone fluids are used in lubricating greases to any extent. This is because the synthetics mentioned best provide the combination of properties required in the finished lubricants.

Specifications set up by military agencies are listed and ideas given as to the range of application of each. Such lubricating greases are used in aircraft and in instrument lubrication because the relatively wide temperature range covered by the specifications cannot be met by conventional products containing mineral oils. The synthetic fluids used have higher viscosity indices and lower volatility than petroleum oils.

Such lubricating greases are specialty products which accounted for about four per cent of the military's total grease purchases in 1957 and 1958. Since the major portion of the synthetics was used by the military, the proportion sold by the grease industry would be considerably less than the above figure.

Effect of Thickener-Particle Dimensions of Lubricating-Grease Properties

A. C. Borg and R. H. Leet.
Lubrication Engineering 15, p. 450-3 (1959).

Four lubricating greases were made of seven per cent lithium 12-hydroxy stearate in a solvent-extracted oil having a viscosity of 100 SUS at 100°F. and a V.I. of 55. Different methods of preparation were used to make products of the same consistency, but with thickener particles of different average length-to-width ratio, (L/W). Tests on these lubricants permitted the following conclusions: (a) mechanical stability increases with L/W ratio; (b) age-hardening decreases with increase in L/W ratio; (c) oil separation increases with L/W ratio.

Discussion by J. Panzer, p. 453-4

This investigator in working with calcium grease systems reached the following conclusions: as the particle size of the thickener decreases, the consistency increases, the degree of breakdown on shear increases, oil separation decreases, and the change in consistency on aging increases.

Additives

Additives—A Way to Quality

In the September, 1959 issue of *Petroleum Refiner* (v. 38, No. 9, pp. 203-226), five articles appear devoted to additives. These are: (1) What Additives Will Do in Gasolines; (2) In Other Fuels; (3) In Motor Oils; (4) In Other Lubes and (5) In Other Products. Our interest is in the last two which are discussed respectively by L. W. Manley and A. W. Lindert.

Manley mentions the general types of additives used in automatic transmission fluids and in automotive and industrial gear oils, in each case indicating the approximate tonnage and money value of the type additive in question. The functions of the various additives are discussed briefly. The following table brings these figures together:

BARRETT
DP-4
Drum
Pump

Rapidly removes viscous products from the 400 lb. open-head drum and wipes the sides clean. Minimum agitation.
• High volume — low pressure
• Drum is never lifted
100% air operated. Ask for details.

BARRETT
Manufacturing Co.
P. O. Box 8096, Houston 4, Texas

Additives	*Yearly Requirements Million Pounds*	*Value in Dollars*
VI Improvers	15	3,000,000
Defoamants	Insignificant	—
Detergent-Antioxidant	15	4,000,000
Lubricity Agent	2	400,000
Automotive Gear Oils	30	9,000,000
Industrial Gear Oils	10	2,000,000

Lindert classifies the thickeners used in lubricating greases as additives and devotes a page to a description of what these thickeners consist of. These additive-thickeners are estimated at 60 million pounds per year in this country with a value of about $20 million. No mention is made of additives used in lesser amounts in lubricating greases such as antioxidants, EP agents, etc.

Equipment

Smooth Lines Handle Grease Easily

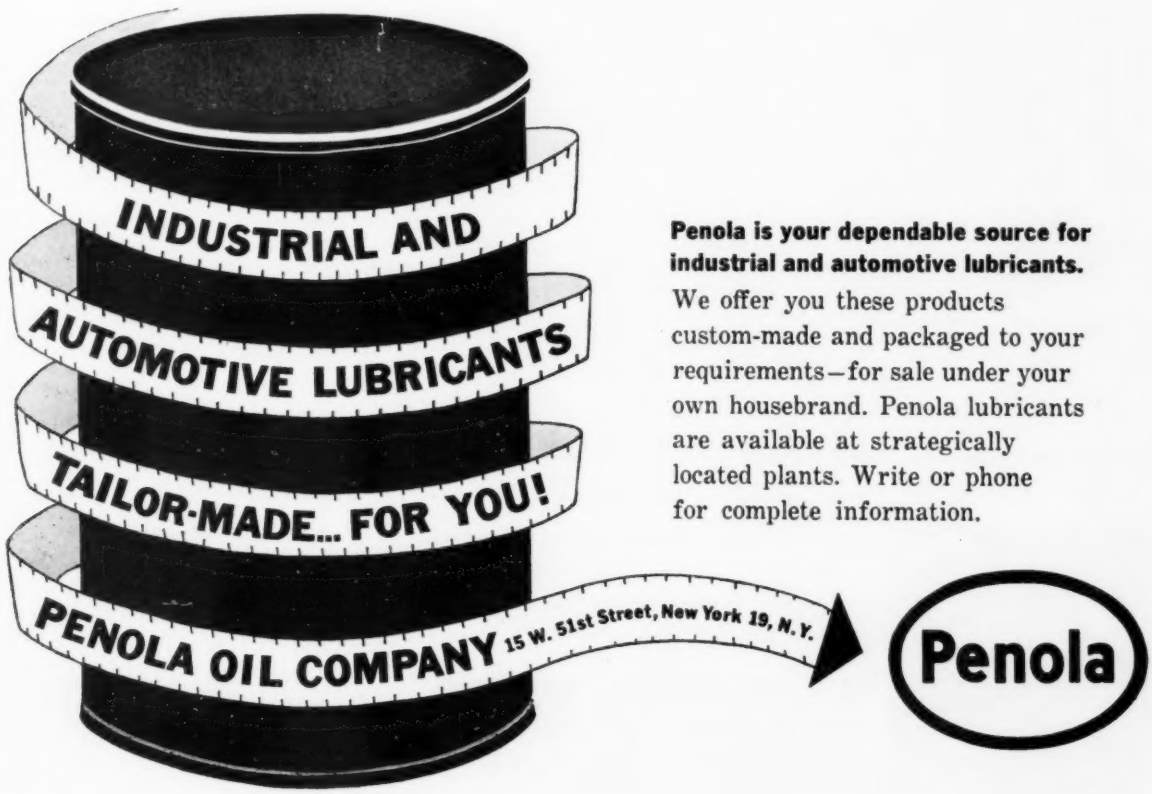
Three photographs, on page 202 of the September, 1959 *Petroleum Refiner* (v. 38, no. 9), illustrate how Esso Standard Oil company's Pittsburg plant prevents contamination during pumping of lubricating greases. Neoprene balls are used to pig the lines before changing grades of grease. Also a piping jump-board allows the operator to direct various kinds of grease products through production machinery, to storage tanks or to a central container filling area. Three inch steel pipes to the jump-board are connected at this point by flexible hose with snap-on couplings. It is stated that the system now uses six filling lines where previously twenty separate lines were required.

Application

The Development, Testing and Application of Petroleum Based Launching Lubricants. G. H. Clark and D. A. Davidson, *J. Inst. Petroleum* 45, 175-196 (1959).

As the title and length of the article indicate, the discussion of launching lubricants and their characteristics is quite complete. This is concerned with lubricants applied to wood sliding ways attached to the ship's hull and lubricants applied to fixed or standing ways which extend from the bows of the ship down into the water. The lubricants which are applied to the wood sliding surfaces must not only support the weight of the ship but also prevent wood to wood contact and have low frictional characteristics.

Two compounds are normally used, the first or base coat and on



Penola is your dependable source for industrial and automotive lubricants.

We offer you these products custom-made and packaged to your requirements—for sale under your own housebrand. Penola lubricants are available at strategically located plants. Write or phone for complete information.

Penola

top of this a slip coat. The base coat, applied in thicknesses of one-eighth to three-eighths of an inch, should withstand the maximum loads during launching without squeezing out; be easy to apply in a molten state; upon cooling form a smooth, even surface; adhere to wood; be water resistant; not become brittle during cold weather; and not soften unduly at summer temperatures. The slip coat should be easy to apply cold and water resistant.

While no specific formulations are given, comparative launching data are tabulated for sister tankers of 3,000 tons weight. In one, a tallow compound (tallow is often mixed with paraffin wax) was used with soft soap as the slip coat. In the other case, a petroleum base coat was used with a calcium base lubricating grease as the slip coat. Results were quite similar with the velocity down the ways being about 17 per cent faster with the last lubricant cited.

It is stated that the coefficient of static friction varies with either type of lubricant being 0.004 to 0.023 with the tallow compound and 0.001 to 0.022 for the petroleum lubricant.

In launching a 47,000-ton tanker, it is estimated that about 30,000 pounds of base coat would be required. The amount of slip coat (calcium base grease) would be about the same if applied one-quarter of an inch thick. Where wax-type base coats are used, some of the product is often salvaged and remelted for use in another launching.

Process

Method of Preparing Mixed-Salt Containing Lubricating Greases

Beerbower and Gay in U.S. Patent 2,909,485 (assigned to Esso Research and Engineering Co.) suggest that, in the manufacture of lubricating greases in which the thickener consists of mixed-salt material comprising alkaline earth soaps and salts, that acetic acid anhydride be used in place of acetic acid. By so doing, it is stated that grit-free lubricants are formed. Further advantages in processing are that less water is formed and a higher heat of reaction takes place when the anhydride is used in place of the acetic acid. Formation of the thickener may take place either batchwise in pressure equipment or preferably in continuous equipment.

As an example, two mixtures were made as follows: 30 grams of hydrated lime; 10 grams of hydrogenated fish oil fatty acids; 10 grams of hydrogenated castor oil; were dissolved in 68 grams of mineral oil having a viscosity of 600 SUS at 100°F. The mixture was heated to 220°F. to dissolve the acids, then cooled and 342 of the oil added. To one such mixture 40 grams of acetic acid were added and to the other 35.3 grams of acetic anhydride. The temperature rise in the first case was 70°F. and the final product was slightly gritty, whereas in the second case the temperature rise was 113°F. and the resulting product was grit-free.

Emery Adds Three to Its Research Department Staff

Additions to the research department staff of Emery Industries include Herbert G. Rodenberg, Paul J. Kemper, and John F. Morrow. In making the announcement, Dr. Charles G. Goebel, Emery's research director, stated that the appointments are part of an overall expansion of Emery's technical staff.

Mr. Rodenberg is engaged in the investigation of oleochemical derivatives in Emery's derivatives section, working under the direction of Dr. H. F. Oehlschlaeger, section manager. Prior to joining Emery, he was associated with U. S. Industrial Chemicals Company in Tuscola, Illinois.

Mr. Kemper is also a member of the derivatives section. He comes to Emery from Interchemical Corp.'s finishes division in Cincinnati.

Mr. Morrow is working in the polymerization section, which is headed by Dr. F. O. Barrett. He is conducting research on Emery's polymerization process, which produces dimer and trimer acid from unsaturated fatty acids.

LUBRICATING GREASES • METALWORKING LUBRICANTS • SPECIAL PROCESS OILS

BEMOL

BEMOLybdenum Fortified Lubricants

mbi

ON GUARD SINCE 1888

Never Underestimate the Importance of Protective Lubrication

MAGIE BROS. OIL CO.

Franklin Park, Illinois • Chicago Phone TU 9-4800

WANTED

Sales Engineer

Major oil company wants experienced Industrial Lubricant Sales Engineer to develop Texas and Louisiana Gulf Coast business. Address resume experience and accomplishments to: Box 223, NLGI SPOKESMAN.

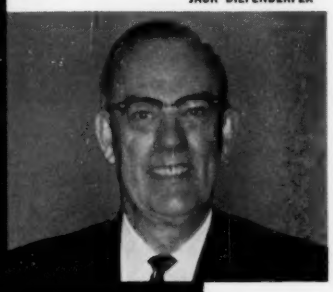
Introducing from the

House of "good" Grease

our "BIG" FIVE*

(E Fortified)

G. L. McCUMBER



JACK DIEFENDERFER

CLARKE BARBOUR

DON RICKETTS

RALPH AXSOM

This hasn't anything to do with their physique . . . these men are big only when it comes to the Energy, Enthusiasm, Experience, Education, and Enterprise they regularly display in their day-to-day field work. This fast-moving, far-ranging, qualified staff of SOWESCO lubrication sales engineers stand ready to place these BIG "E" qualifications to work for you, too!

Yes, these men can do a "BIG" job for you. We're proud of their customer service records, proud of their ability to assist you with your sales engineering problems. Their BIG "E" qualifications build "Hidden Value Factors" into every one of our products . . . another good reason why we at SOWESCO The House of "good" Grease — recommend that progressive private-brand lubricant marketers **look behind the product** . . . for "The Hidden Value Factors."

* Your inquiries will be enthusiastically received and handled by:

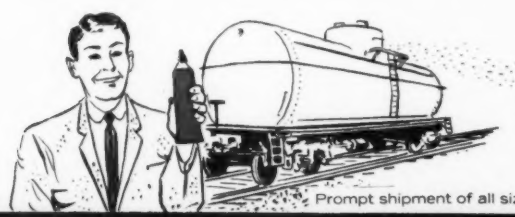
G. L. McCUMBER
1459 Woodland
Wichita, Kansas
Tele.: AMherst 2-7165
Midwestern (Lower) and Southeastern Territory

JACK DIEFENDERFER
1085 Sherman
Denver 3, Colorado
Tele.: ALpine 5-8241
Western Territory

CLARKE BARBOUR
2205 King Avenue
P. O. Box 164
Fort Worth, Texas
Tele.: TErminal 4-4161
Southwestern Territory

DON RICKETTS
3522 Annear Street
Ames, Iowa
Tele.: CEdar 2-4463
Midwestern (Upper) Territory

RALPH AXSOM
6237 Anita Drive
Parma Heights 30, Ohio
Tele.: TUxedo 6-3239
Eastern Territory



There's only ONE Leader

SOUTHWEST good GREASE

Prompt shipment of all size packages . . . from tubes to tank cars

SPECIALIZING IN THE CUSTOM MANUFACTURE OF PETROLEUM LUBRICATING GREASES AND SPECIALTIES

SOUTHWEST GREASE & OIL CO., INC.

220-230 WEST WATERMAN • WICHITA 2, KANSAS

Industry News

Expansion Program Planned By Jesco Lubricants Co.

The first step in the long-range planned expansion of Jesco Lubricants Co. has begun. The recent purchase of the Long Bell building directly south and adjacent to their present property now expands the Jesco operation to a complete city block in North Kansas City, Mo.

The new acquisition consists of 40,000 square feet of vacant land and a two-story brick building with 85,000 square feet of floor space. The building is serviced by two large freight elevators. The dock space permits the loading and unloading of six box cars and four trucks simultaneously which will speed up shipping and receiving.

With the addition of this property and building, Jesco is now in a position to further expand its manufacturing facilities. The new building will be connected with the present Jesco building by a conveyor system and runways which will permit palletizing. The new conveyor system will carry the finished products from the manufacturing floor in one continuous chain to the storage and shipping area, thereby eliminating excessive handling. This system will give Jesco one of the most modern grease plants in the country today.

Jesco Lubricants Co. was organized in 1929 and from the very start was a pioneer in the testing of new types of manufacturing equipment. The first Stratford contactor and hot oil circulating system was tested and used at Jesco. Today Jesco is the only independent grease manufacturer using this type of equipment. New innovations in processing equipment and processing such as deaerating, dehydrating and centrifuging can be attributed to years of testing and research in the Jesco plant.

The Jesco plant has attracted visitors from all over the world who are interested in learning new techniques in grease manufacturing.

McGEAN
30% LEAD NAPHTHENATE ADDITIVE

- Consistently uniform in metallic content and viscosity
- Fully clarified by filtration
- Non-Oxidizing - - - contains no unsaturated soaps
- Free from low flash constituents

McGEAN CHEMICALS

THE McGEAN CHEMICAL COMPANY
1040 MIDLAND BLDG.
CLEVELAND 15, OHIO

Farval Offers New Lubrication Brochure

A newly-revised general brochure now contains information on the complete line of centralized systems of lubrication offered by Farval division, Eaton Manufacturing company.

The booklet has been increased to 24 pages to cover new additions to the Farval line. Advantages of Farval centralized lubrication and principles of operation are discussed, as well as system components. Illustrations of typical applications are also included.

The new Bulletin No. 26-T is available upon request to Farval division, Eaton Manufacturing company, 3300 East 80th St., Cleveland 4, Ohio.

Canco's New Atlanta Plant Formally Opened

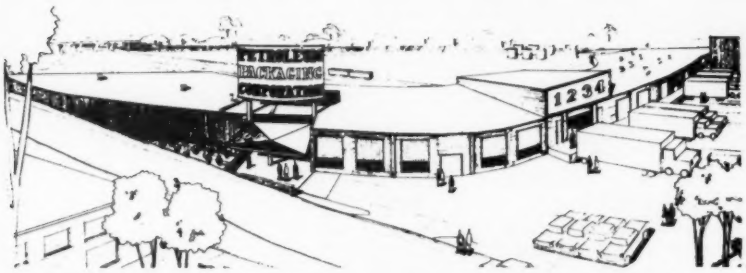
Opening of the new Atlanta plant of the Canco division of the American Can company was celebrated in March with formal dedication ceremonies and an open house and plant tour that day. Governor S. Ernest Vandiver and William F. May, vice-president and general manager of the Canco division, took part in the formal opening ceremonies.

The modern one-story plant occupies approximately 150,000 square feet of floor space on a fifteen-acre landscaped plot in Forest Park on Lake Mirror road, Clayton county. It is fourteen miles south of downtown Atlanta, one-half mile east of Expressway 41 S.

The public had an opportunity to see some of the most remarkable high-speed and automatic production facilities of modern industry. Four production lines are already in operation. A single line may produce metal containers with incredible precision at speeds up to 500 a minute.

The C. W. Nofsinger Company
CONSULTING ENGINEERS
Grease Plants
Petroleum Refineries
Petrochemicals
"In Engineering It's the People That Count"
307 East 63rd Street
Kansas City 13, Missouri

New Petroleum Packaging Firm Established in St. Paul



THIS large, one-story plant will contain the most modern, high-speed automatic packaging and conveying equipment and extensive tank facilities.

Formation of a St. Paul firm with facilities for the largest and most modern push-button petroleum packaging plant in the entire country has been announced by George J. Rutman, St. Paul, veteran Minnesota oil executive.

The new organization, known as the Petroleum Packaging corporation, will locate its terminal operations on a six and one-half acre tract of land with extensive trackage facilities and with a frontage of 1,000 feet on a new interstate freeway.

According to Rutman, president of the new corporation, the plant will be operational in about 90 days and will employ from 50-100 people.

"The facilities of this sprawling one story plant with more than 100,000 square feet of floor space and the most modern, high-speed automatic packaging and conveying equipment and extensive tank facilities will allow us to package, warehouse and ship petroleum or chemical products for major industry at a speed and economy which previously was out of the question in the oil industry in the Midwest," Rutman said.

The Industrial Steel Container company of St. Paul, also headed by Rutman, will supply the steel containers for the new company. A plastic container division will also be added.

"Many firms, especially those in the petro-chemical and edible oil field, plan to base their storing, packaging, and shipping operations in this new Petroleum Packaging corporation terminal," Rutman said.

A modern grease manufacturing facility along with the only synthetic grease operation in this area will be installed in the new terminal and large volumes of finished lubricating grease will be packaged and shipped to all parts of the United States and Canada. A large research and technical staff division will also be included in the company.

Rutman is also president and Company Representative of the NLGI Active member firm of Sta-vis Oil company in St. Paul. The new corporation is a separate business and is not a part of Sta-vis.

Sonneborn Adopts New Name, Symbol After 57 Years

L. Sonneborn Sons, Inc., 57-year-old New York petroleum refiner and manufacturer of chemical specialties, changed its name to Sonneborn Chemical and Refining corpoartion, Rudolf G. Sonneborn, president of the company, announced last month.

In petroleum refining, Sonneborn specializes in medicinal cosmetic and technical white oils, medicinal and technical petrolatums, petroleum sulfonates, petroleum waxes, and Pennsylvania motor oils and lubricants. These are produced in the company's refineries at Petrolia, Pa., and Franklin, Pa.

Sonneborn also operates a plant in Belleville, N. J., where the building and maintenance specialties, Amalie-brand grease lubricants, textile chemicals, Whistlecleanbrand industrial detergents, and products for other industries, are manufactured.

In conjunction with the proposed name change, Mr. Sonneborn also announced a new company-developed symbol, which will be incorporated into all printed sales and corporate material of the company.

"We believe that this new name and symbol present a more meaningful picture of our company's activities," Mr. Sonneborn said.

He went on to state that "the change in name will not involve any changes in personnel or in policy."

Founded in 1903, Sonneborn has rapidly grown to become one of the leading white oil and petrolatum refiners.

Company headquarters are located at 300 Park Avenue South.

HARSHAW LEAD BASE

Harshaw Lead Base, as an additive to petroleum lubricants, improves extreme pressure characteristics and imparts the following desirable properties:

- Increased film strength
- Increased lubricity
- Improved wetting of metal surfaces
- A strong bond between lubricant and metal surfaces
- Resistance to welding of metals at high temperatures
- Moisture resistance and inhibits corrosion

Harshaw Lead Bases are offered in three concentrations to suit your particular needs:

Liquid	Liquid	Solid
30% Pb	33% Pb	36% Pb

Other metallic soaps made to your specifications. Our Technical Staffs are available to help you adapt these products to your specific needs.

THE HARSHAW CHEMICAL CO.
1945 E. 97th Street • Cleveland 6, Ohio
Branches In Principal Cities

New Headquarters for American Metal Climax

Headquarters office personnel of American Metal Climax, Inc., and its operating divisions have occupied space in a modern building bearing the company name at 1270 Avenue of the Americas in Rockefeller Center, N. Y. As a result company executive management and its staff personnel are together under one roof for the first time since the company was formed at the close of 1957 by merger of American Metal Company, Ltd., and Climax Molybdenum company.

Metal Container Firms Consolidate

Formation of a new company, Vulcan-Associated Container Companies, Inc., and the merger of seven container manufacturers, were announced by Gordon D. Zuck, president of the new company.

The new organization will have its headquarters and executive office at Birmingham, Alabama. The companies merged into the new corporation are:

- Vulcan Containers, Inc., Bellwood, Illinois
- Vulcan Steel Container Co., Birmingham, Alabama
- Southwestern Steel Container Co., Dallas, Texas
- Vulcan Containers Ltd., Toronto, Canada
- Vulcan Containers Ltd., Vancouver, B.C., Canada
- Vulcan Containers Pacific, Inc., San Leandro, California
- Atlantic-Vulcan Steel Containers, Inc., Peabody, Massachusetts

These companies manufacture a variety of sizes and styles of steel pails and drums and specialty tin cans for paints and lacquers, agricultural chemicals, insecticides, sanitary chemicals, soaps and waxes, printing inks, lubricating and industrial oils and greases, and food products.

Mr. Zuck, president of Vulcan-Associated, will headquarter at Birmingham where he will head-up the parent company's program of coordination of all activities of the seven merged firms. He has over 28 years of experience in the metal container business, and was formerly an officer of one of the oldest steel container manufacturers in the nation. He is president of the Birmingham, Dallas and Boston companies participating in the merger.

Mr. Zuck said that while the parent company will own all stock of the merged companies, each company will maintain its corporate identity and will operate individually in each area. The seven companies will each function under the direction of its board of directors and staff of officers. At the same time, the combined strength and versatility of the group will be used to increase efficiencies, quality and sales-service coverage to users.

Vern I. McCarthy, Sr., will serve as chairman of the board of directors of the new corporation. He will headquarter at Bellwood and will devote his efforts to overall development programs of the companies including research and foreign operations. His father founded the Bellwood company in 1916. Vern, Sr. became president in 1942. In December, 1959, he became board chairman and turned the presidency of the Bellwood company over to his son, Vern, Jr., who is now the third generation to head-up that organization.

Vern I. McCarthy, Jr., is treasurer of the associated company. He will devote his time to the position of president and director of sales of the Bellwood company. (McCarthy, Jr., is NLGI Company Representative for the firm).

DENCO

Manufacturers of Lubricants (since 1901)

Manufactured and Packaged to Your Requirements

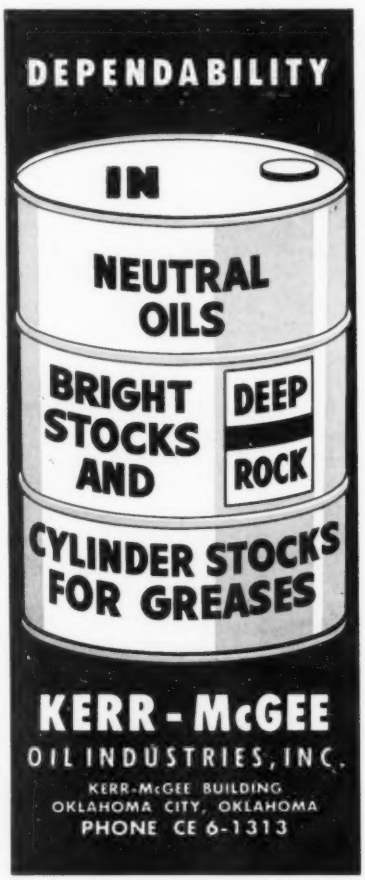
Call or write

DENCO PETROLEUM COMPANY

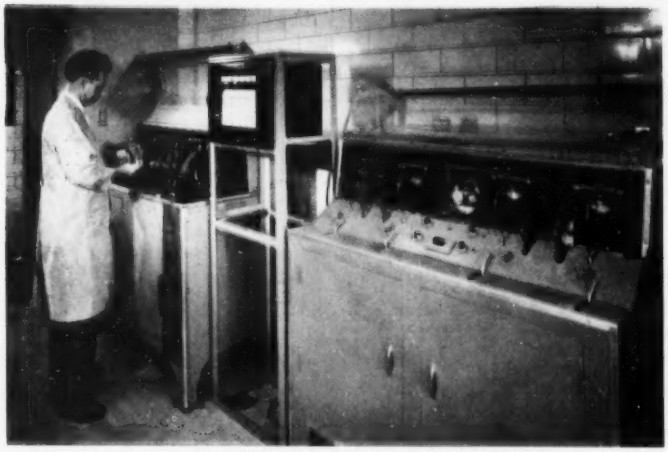
5115 DENISON AVE.

CLEVELAND 2, OHIO

OLYMPIC 1-6600



INTERNATIONAL LUBRICANT'S SCIENTIFIC CURIOSITY GIVES YOU FINER GREASES



Often International scientists develop their own specialized testing apparatuses such as these Oscillating Friction machines which duplicate the gruelling driving conditions of automotive front end, spring and chassis action.

Checking, testing, developing new greases and new ways to improve present greases has been a never-ending research assignment at the International Lubricant Corporation.

This year, International celebrates its 30th Anniversary with the opening of a great new research laboratory rededicated to the policy of guarding quality and the development of new products . . . to give you newer and finer greases for today's automotive, aviation, marine, industrial and high-powered missile equipment.

In this new Technical Library, equipped with specification books, reports, general reference volumes and periodicals, essential literature research is completed before laboratory investigation is started.

INTERNATIONAL LUBRICANT CORP.

NEW ORLEANS, LOUISIANA

Manufacturers of top quality lubricants: Aviation • Industrial • Automotive • Marine

With Research Comes Quality, With Quality Comes Leadership

People in the Industry

D. F. Mahony Joins Climax Molybdenum Co.

The appointment of Daniel F. Mahony as assistant manager—lubricant development for Climax Molybdenum company, a division of American Metal Climax has been announced by Reuel E. Warriner, vice-president—sales. Mr. Mahony will be located at the company's New York offices at 500 Fifth Ave.

In his new position, Mr. Mahony will further develop the markets for Climax's molybdenum disulfide grease additive at the service station level, and promote technical and general line sales. He will also be exploring new markets for the additive in related fields.

Before joining Climax, Mr. Mahony was employed in the marketing department of the Shell Oil company and had responsibilities in technical sales, lubrication development and service station merchandising. He graduated from the United States Military Academy at West Point and served in the U. S. Army Quartermaster Corps in the fuels and lubricants department. Mr. Mahony left the Army with the rank of captain at the end of the Korean emergency in 1953.

FISKE BROTHERS REFINING CO.

Established 1870

★

NEWARK, N. J.

TOLEDO, OHIO

★

Manufacturers of

LUBRICATING GREASES

United Co-Operatives Names A. J. Miller

Albert J. Miller, former assistant manager of United Co-Operatives' petroleum department, Alliance, Ohio, was named manager as of February 1, 1960, as announced by A. E. Young, director of operations.

Mr. Miller replaces G. E. Castree, the former manager who left the organization in January.

Miller, a native of Ranger, Texas, is a graduate of Texas Christian university. His affiliation with United Co-Operatives began in 1955 as a TBA product specialist at United's San Mateo, California office. He came to the Alliance main office in March, 1957.

To Head New Division in Du Pont's Petroleum Lab

Paul H. Richard, for the last five years automotive liaison representative of Du Pont's petroleum chemicals division in Detroit, has been named head of a new automotive division in the company's petroleum laboratory. Succeeding him as Detroit liaison representative is Max W. Corzilius, who since 1951 has been attached to the petroleum laboratory as a research engineer.

Paul H. Richard, a native of Erie, Pa., obtained his bachelor of science degree in mechanical engineering from the Pennsylvania State university in 1942 and until mid-1947 was associated with the National Advisory Committee for Aeronautics, in whose Cleveland, Ohio, laboratories he conducted research on fuels and lubricants for aircraft engines. After two and a half years as a control engineer with the Lima-Hamilton corporation, where he carried on experimental studies of railroad diesel engines and free piston machinery, he joined the Du Pont company late in 1949 as an automotive technologist and engineering test group leader at its petroleum laboratory. Since early 1955 he had been the division's Detroit representative and liaison agent with the automotive industry.

Kerr-McGee Creates New Department

Kerr-McGee Oil Industries, Inc., has established a new department to coordinate the technical activities of the company and its subsidiaries in the fields of petroleum producing, refining and marketing.

This department, known as product development and quality control, is under the supervision of Dr. D. R. Frey, general manager. Others thus far assigned to the department are: L. W. Okon, manager of sales technical services; F. C. Champlin, chief chemist; and H. L. Norlin, laboratory supervisor. Offices and facilities are located at 36th and Santa Fe in Oklahoma City.

The new department will act as liaison between marketing and manufacturing in the development of new products and changes of existing products. It will also provide technical service to refining, marketing and management by handling customer inquiries on the use of Kerr-McGee products, training salesmen, conducting special tests and analyses, and investigating processes and techniques for improving product quality.

$CH_3COCl + LiH \rightarrow CH_3CHO + LiCl$

making the most of lithium hydride

Lithium hydride is one of the most versatile metal hydrides available to the chemist. Long known for its unique solubility properties as compared with other alkali metal hydrides, this lithium compound has amassed an impressive number of applications—both present and future—that go far beyond original expectations. A few examples are in order:

. . . as a reducing and condensing agent

Lithium hydride can convert carbon dioxide to free carbon . . . can reduce acetyl chloride to acetaldehyde and lithium chloride (illustrated above) . . . can be used to prepare new hydrides which would otherwise be unobtainable except in small yields and by difficult synthesis . . . functions efficiently in many organic condensation and reduction reactions . . . and can easily be increased in solubility or controlled in reactivity by conversion to mixed hydrides.

. . . as a catalyst

Lithium hydride reacts with alcohols to form lithium alcoholates and hydrogen. This reaction makes possible the convenient preparation of anhydrous lithium alcoholate which is useful as an alcoholysis catalyst.

. . . as a hydrogen bank

Lithium hydride is an ideal source of hydrogen . . . just one pound of lithium hydride will generate as much as 45 cubic feet of hydrogen gas at S.T.P. This gives you more hydrogen per unit of weight than can be secured by using "bottled" gas in steel containers.

. . . as a nuclear shielding material

N_H of lithium hydride is 5.90 compared to 6.68 for water at room temperature. And because of its low dissociation pressure at its melting point (27 mm at 680°C.), lithium hydride can be heated to red heat in a thin-wall container . . . without requiring a pressure shell. It appears to be stable indefinitely at this temperature.

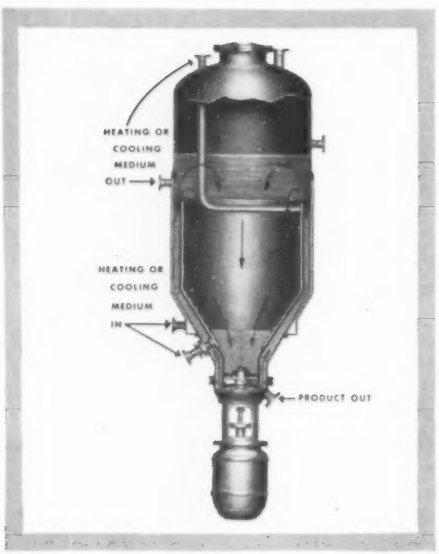
These and many other useful characteristics of lithium hydride may help improve your product or process. For complete technical data, write for Bulletin 102. Address request to Technical Literature Dept., Foote Mineral Co., 402 Eighteen West Chelten Bldg., Phila., 44, Pa.

FOOTE MINERAL COMPANY

LITHIUM CHEMICALS, METAL, MINERALS • STRONTIUM CHEMICALS • WELDING GRADE FERRO ALLOYS • ELECTROLYTIC MANGANESE METAL • STEEL ADDITIVES • COMMERCIAL MINERALS AND ORES • ZIRCONIUM, TITANIUM, HAFNIUM (IODIDE PROCESS)

STRATCO
Reg. U. S. Pat. Off.

CONTACTORS ARE USED IN GREASE PLANTS AROUND THE WORLD . . .



Making more uniform soaps

- *. . . in less time*
- *. . . with less manpower*
- *. . . and producing a higher yield grease.*

Available in sizes from 2 gal. volume (16#) laboratory units up to 2,800 gal. (22,400#) or larger sizes.

• PETROLEUM REFINING ENGINEERS

STRATFORD ENGINEERING CORPORATION

612 West 47th St. **Kansas City 12, Mo.**

REPRESENTATIVES

D. D. Foster Co., Pittsburgh, Pa.
D. D. Foster Co., S. Charleston, W. Va.
Lester Oberholtz, Los Angeles
Rawson-Houlihan Co., Inc., Houston
The Rawson Co., Inc., Baton Rouge
F. J. McConnell Co., New York